**ENCLOSURE 1**

# LICENSE AMENDMENT REQUEST 239, SUPPLEMENT 1 – REQUEST FOR REVIEW AND APPROVAL OF SEISMIC ANALYSIS METHODOLOGY FOR AUXILIARY BUILDING CRANE

**ACECO CALCULATION NO. CAL-20776-SE-007**

**KEWAUNEE POWER STATION**

**DOMINION ENERGY KEWAUNEE, INC.**

**AMERICAN CRANE & EQUIPMENT CORPORATION**

| | | | |
|---|---|---|---|
| JOB NO.: | 20776-2 | CALCULATION NO.: | CAL-20776-SE-007 |
| CALCULATION TITLE: | Auxiliary Building Crane Non-Linear Seismic Analysis | | |
| CUSTOMER: | Dominion Electric Kewaunee (DEK) | | |
| PROJECT: | Upgrade of KPS Auxiliary Building Crane to Single Failure Proof | | |

# CALCULATION COVER SHEET

This Calculation Requires Verification Per AP-20.4: ■ Yes ☐ No

| REV. NO. | ORIGINATOR | VERIFIER | APPROVAL | OPEN ASSUMPT'S Yes or No | ALL ASSUMPT'S CONFIRMED Yes or No |
|---|---|---|---|---|---|
| | DATE | DATE | DATE | | |
| 0 | Pat J Rice | Richard Schmidt | [illegible] | No | N/A |
| | 9/4/08 | 09/04/2008 | 9/4/08 | | |
| 1 | Pat J Rice | Richard Schmidt | [illegible] | No | N/A |
| | 9/11/08 | 09/11/2008 | 9/11/08 | | |
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# CALCULATION REVISION SUMMARY SHEET

| REV. NO. | REASON FOR REVISION | PAGES CHANGED OR ADDED | TOTAL PAGES |
|---|---|---|---|
| 1. | INCORPORATE CLIENT COMMENTS ALL CHANGES ARE EDITORIAL IN NATURE. | PGS 1- 18 ATTS. A, C, G, J, K, N | SAME |
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# DESIGN VERIFICATION RECORD

| A. CALCULATION | | | | REV.: 1 |
|---|---|---|---|---|
| 1. | A computer program was used for this calculation revision. | ☐ Not Used | ☒ Used | |
| | Computer Program Name | Rev. | Validated & Used within Limits of Validation (Yes or No) | |
| | SAP2000 | 11.0.1 | Yes | |
| | | | | |
| 2. | ORIGINATOR: R. A. Rizzo | DATE: 9/11/08 | | |

| B. VERIFICATION REQUIRED | | | | |
|---|---|---|---|---|
| ☐ No | Reason: | | | |
| ☒ Yes | Method: | ☒ Design Review | ☐ Alternate Calculation | ☐ Qualification Testing |
| | Verifier/Verification Team: | | | |
| | Richard Schmehl | | | |
| ENGINEERING MANAGER: | | DATE: 9/11/08 | | |

**C. VERIFICATION COMMENTS AND RESULTS:**

The calculation is acceptable.

During the process of preparing the calculation, a problem was observed with the one node non-linear support element in SAP2000. CSI (SAP2000) initiated Incident Report 15858 in regard to this problem and recommended that the two node non-linear link element be implemented in the model. As a result, exercise care when utilizing the frame element member forces (in the direction of trolley or bridge rolling) in elements adjacent to the two node non-linear link elements.

| D. COMPLETION OF VERIFICATION AND APPROVAL | |
|---|---|
| VERIFIER'S SIGNATURE: Richard Schmehl | DATE: 09/11/2008 |
| ENGR. MANAGER'S APPROVAL: | DATE: 9/11/08 |

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| PROJECT: | Upgrade of KPS Auxiliary Building Crane to Single Failure Proof | | |

# CALCULATION DESIGN REVIEW CHECKLIST

REV.: 1

| | DESIGN REVIEW QUESTIONS | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is the purpose of the calculation clearly stated? | ✓ | | |
| 2. | Have the correct design inputs been referenced and was the design input obtained from valid sources? | ✓ | | |
| 3. | Are proper references listed? | ✓ | | |
| 4. | If a computer program(s) was used, is the program and version level clearly documented, the computer used identified, and the status of the program validation defined? | ✓ | | |
| 5. | Are the bases for the assumptions stated? | | | ✓ |
| 6. | Are assumptions requiring future confirmation identified as such in the calculation and entered on the Design Input Record/Calculation Log? | | | ✓ |
| 7. | Are the methods used to perform the calculation clearly documented and technically correct? | ✓ | | |
| 8. | Are the sources of input values, nonstandard formulas, coefficients, and symbols documented? | ✓ | | |
| 9. | Are units identified and correct? | ✓ | | |
| 10. | If spot calculation checks were performed as part of the review, were the check results in agreement with the calculation results? | ✓ | | |
| 11. | For computer program runs, was the proper input data used and the output results reasonable? | ✓ | | |
| 12. | Do the conclusion and results satisfy the calculation purpose and identified acceptance criteria? | ✓ | | |

Comments:

VERIFIER'S SIGNATURE: Richard Schmidt

DATE: 09/11/2008

# CAL-20776-SE-007
# AUXILARY BUILDING CRANE
# NONLINEAR SEISMIC ANALYSES

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## 1.0 PURPOSE

This calculation documents the nonlinear seismic analyses that develop the forces used to qualify the Kewaunee Power Station Auxiliary Building new trolley and existing crane bridge. The nonlinear analysis is conducted in order to model crane bridge and trolley drive wheel rolling when seismic inertial forces exceed the brake holding resistance.

The analyses are done in accordance with the Kewaunee crane upgrade [1] and follows the ASME NOG-1-2004, Section 4150 [3] rules for seismic analyses with the exception of modeling the drive wheel nonlinear rolling resistance.

The crane is classified as CMAA 70 Class A [D1].

### 1.1 Crane Description

The crane has an eight wheel bridge (existing) with a four wheel top running trolley (new). The bridge consists of two box girders, two end ties and four trucks.

Table 1.1 lists the major attributes describing the crane.

**Table 1.1 Crane Description**

| Crane Attribute | Value |
|---|---|
| **Trolley Weight** | 112 k |
| No. Trolley Wheels | 4 |
| Trolley Wheel Base | 12'-2" |
| Trolley Gage | 20'-0" |
| Rated Load – Main Hoist: | 125 tons (250 k) |
| Rated Load – Auxiliary Hoist | 15 tons (30 k) |
| **Bridge Weight (existing)** | 106 k |
| Bridge Span | 82'-6" |
| No. Bridge Wheels | 8 |
| Inside Wheel Base | 14'-0" |
| Outside Wheel Base | 28'-0" |
| No. Bridge Trucks | 4 |
| Truck Wheel Base | 6'-0" |
| **Total Crane Weight** | 218 k |

### 1.2 Analysis Description

A nonlinear modal time history analysis analysis method is used to develop the crane qualification seismic forces (moments, shears, displacements,etc.). The modeling and analysis is conducted in accordance with the guidance in the SAP 2000 Version 11 Analysis Reference Manual [4]. The nonlinear behavior that is being modeled is specific to the bridge and trolley drive wheel rolling on the rails when the seismic inertia forces exceed the drive wheel brake resisting force. The bridge and trolley structure remain in the elastic range throughout the analysis.

The nonlinear bridge/trolley rolling resistance functions are represented by the SAP 2000 Link/Support Element which is described in detail in Attachment O. The nonlinear time-history analyses are performed using a nonlinear modal time-history analysis approach which is an extension of the Fast Nonlinear Analysis Method [4]. This solution method is applicable when the nonlinearity is restricted to Link/Support Elements as is the case for the analysis of the Kewaunee Spent Fuel Crane. Attachment N provides a more in-depth description of solution methodology.

Figure 1.1 shows the nonlinear hysteretic behavior of the SAP2000 Link/Support element used to model crane rolling in the seismic analyses. The element input variables, "**k**," "**yield**," "**ratio**", and "**exp**" determine the hysteretic shape of the seismic response.

**"k"** is the elastic spring constant used during the nonlinear analysis that defines the linear loading and un-loading hysteretic slopes.

**"yield"** defines the force level at the start of yielding. For this analysis yielding is defined as the force that initiates drive wheel rolling. The calculated value for rolling resistance has been increased by factors of 1.25 for the bridge drive wheels and 2.0 for the trolley drive wheels [Attachment B] to provide margin in the analyses

**"ratio"** is the ratio of the post-yield stiffness (strain hardening effect) to the linear stiffness (k). A ratio of zero (flat slope) represents pure elasto-plastic nonlinear behavior.

**"exp"** is an exponential variable defines the transition curvature from elastic to plastic behavior. "exp" of 20 or higher approximates bi-linear behavior. "exp" values of 1 and 2 would model a more rounded, gradual transition.

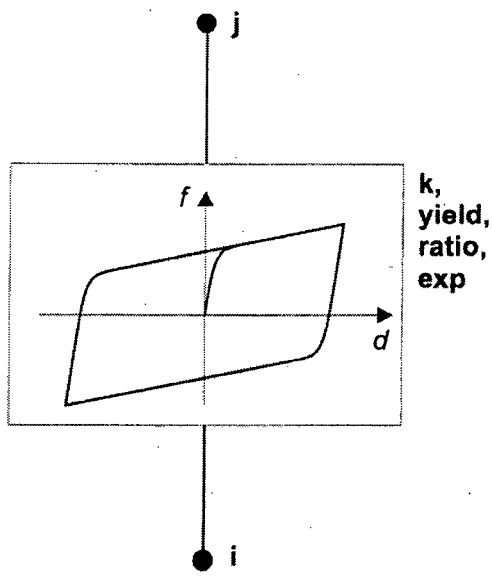



**Figure 1.1 SAP2000 Nonlinear Link/Support Hysteretic Force-Displacement (f,d) Shape**

Bi-linear elasto-plastic behavior is used to model the crane rolling resistance. Accordingly, the input parameters "**ratio**" and "**exp**" are specified to be "0" and "20," respectively for the analyses, herein. The yield forces applicable to the crane trolley and bridge braked wheel rolling (yield) are calculated in Attachment B. The curve elastic stiffness during loading and unloading (**k**) is calculated in Attachment C. Attachment O provides the SAP2000 theoretical basis for the Link/Support element.

### 1.3 Analysis Output

Obtaining member seismic forces for the existing crane bridge structure for the different crane configurations is the primary objective for the analyses. The member forces applicable for the subsequent stress evaluations structurally qualifying the crane are provided in attachment D. Additional more detailed and localized output is provided on the analysis CD to be used as may be needed (e.g. connection design). The seismic member forces are combined with those resulting from the dead and live (lifted load) loadings within the SAP2000 analysis as a load combination (see Section 4.7, below).

Additional design output consists of relative displacements and absolute accelerations (Attachments E and F).

## 2.0 SCOPE

### 2.1 Seismic Analyses

The analyses calculate and combine the crane seismic responses with the crane dead and live loading (lifted loading) response for subsequent trolley and bridge structural qualification. The crane trolley and bridge seismic qualifications will be documented in ACECO calculations CAL-20776-SE-008 and CAL-20776-SE-009 for the trolley and bridge, respectively. The seismic analyses are considered to be "Extreme Environmental" loadings following NOG-1 guidelines [3].

The seismic design basis for the crane is defined by the broadened design response spectra applicable along the top of the runway rail for all crane positions in the Auxiliary Building [7]. Accordingly, the crane seismic model is de-coupled from the runway girders and Auxiliary Building. The analyses, herein, use acceleration time histories developed to match the DBE spectra [6] (Section 4.6.2, below).

### 2.2 Non-Seismic Analyses

The crane CMAA analyses and qualifications for normal operational loadings and other non-seismic loadings (as applicable) are documented in CAL-20776-SE-001 [2].

## 3.0 ASSUMPTIONS

None

## 4.0 DESIGN INPUTS

### 4.1 Materials

Materials are modeled by defining the elastic modulus, Poisson's ratio, and unit weight. The unit weight can be augmented to account for weights associated with attached equipment, as needed.

#### 4.1.1 Crane Structural Steel

The existing crane bridge structure is made of A36 steel. The new trolley uses A572 steel. The properties for both used in the analysis are:

a) E = 29000 ksi Elastic Modulus
b) v = 0.3 Poisson's Ratio
c) w = 490 pcf Unit Weight of Steel

#### 4.1.2 Wire Rope Properties

The suspended main and auxiliary hooks properties used in the analyses are listed in Table 4.1.

**Table 4.1 Wire Rope Properties**

| Attribute | Main Hoist | Auxiliary Hoist |
|---|---|---|
| **No. Ropes** | 16 | 8 |
| **Rope Size** | 1.25 in. | 0.5 in. |
| **Effective Area** | 0.9572 sq. in. | 0.4690 sq. in. |
| **Rope Length – High Hook** | 7 ft. | 6 ft. |
| **Rope Length – Low Hook** | 72 ft. | 71 ft. |
| **Elastic Modulus** | 13,360 ksi | 13,360 ksi |

### 4.2 Section Properties

Section geometric properties used to model the bridge and trolley strength and stiffness characteristics and are calculated in CAL-20776-SE-001 [2] and presented again in Attachment A of this calculation.

Section properties include:

a) Cross-Sectional Area
b) Vertical Shear Area
c) Transverse Shear Area
d) Torsional Constant
e) Strong Axis Moment of Inertia
f) Weak Axis Moment of Inertia

### 4.3 Dead Loadings

Weight properties are modeled as concentrated forces at nodal points and as section property densities. The weights of the crane components are developed in CAL-20776-SE-001 [2]. The weights are also expressed as mass (W ÷ g) and are used to model the bridge and trolley dynamic characteristics (frequencies and mode shapes) used by the dynamic analyses.

a) Trolley Weight:..... 112 kips
b) Bridge Weights:
   Drive girder ..... 45 kips
   Idler girder..... 40 kips
   End Trucks..... 15.75 kips
   End Ties..... 5.25 kips
   Total Bridge ..... 106 kips

The bridge section densities, using the above weights) are calculated directly in the analysis input files (Attachment I).

### 4.4 Live Loadings (Crane Lifted Loadings)

a) Main Hoist....125 Tons (250 kips)
b) Auxiliary Hoist..15 Tons (30 kips)

### 4.5 Link/Support Properties

#### 4.5.1 Wire Rope Horizontal Pendulum Effects (Linear Link/Support Element)

Laterally, the loaded crane hooks behave as pendulums, having lateral frequencies determined by the length of the supporting wire ropes which are independent of the suspended mass. The wire ropes are modeled using linear Link/Support elements by using the hook/loading mass and inputting wire rope lateral stifnness values that match the applicable rope length pendulum frequency.

**Table 4.2 Wire Rope Pendulum Frequency Inputs**

| Attribute | Main Hoist Ropes | Auxiliary Hoist Ropes |
|---|---|---|
| Raised Hook Frequencies | L = 7 ft<br>F = 0.34 Hz | L = 6 ft<br>F = 0.37 Hz |
| Lowered Hook Frequencies | L = 72 ft<br>F = 0.11 Hz | L = 71.33 ft<br>F = 0.11 Hz |

#### 4.5.2 Wire Rope Vertical Effects (Linear Link/Support Element)

Vertically, the suspended mass responds elastically. The vertical, axial stiffness of the wire ropes is calculated as for an elastic rod; K = N x E x A / L. N, E, A, and L represent the number of wire ropes, elastic modulus, effective single rope cross-sectional area, and wire rope length, respectively, as presented in Table 4.1.

#### 4.5.3 Crane Rolling Resistance (Nonlinear Link/Support Element)

The bridge and trolley drive wheel brakes are set when parked or during an earthquake. The brakes are disk brakes having prescribed pre-loaded springs that, when set, apply a constant normal force on the disk. During the seismic event the crane inertial forces overcome the wheel torque developed

by the set brake and the crane rolls. The rolling resistance forces at the braked wheels that overcome the set brake torques are calculated in Attachment B. The rolling resistance is independent of vertical seismic effects, unlike the case for crane sliding. The rolling resistance is modeled as an elastic/plastic effect using the SAP2000 Link/Support element with Wen Plasticity properties. The crane responds elastically without rolling until the seismic inertial forces are sufficient to overcome the rolling resistance. The crane then rolls until the inertial force is less than the rolling resistance.

Figure 1.1, above, shows the SAP2000 Link/Support element with Wen Plasticity properties. In general, it can be applied in each or all six displacement (uncoupled translations and rotations) degrees of freedom.

Figure 4.1 below shows the corresponding elastic/plastic force-displacement relation curve specific for the the crane drive wheel rolling (yield) forces.

Where:

**K** = Elastic spring constant for yield curve. **K** is calculated in Attachment C and provides the elasticity of the Link/Support elements when not yielding for both hysteretic loading and unloading. The stiffness value is set so that relatively small elastic vibration displacements occur before the yield (rolling) force is reached, yet not so high as to cause numerical instabilities during the solution process.

**YIELD** = Rolling resistance is calculated in Attachment B. This value is calculated using the set brake torque and calculating the force at the wheel / rail interface needed to overcome the brake torque.

**RATIO** = Ratio of plastic to elastic stiffness. A finite value would be input to model strain hardening, however, **RATIO** = 0 is used, herein, to model perfectly plastic yielding. Figure 4.1, shows the bi-linear force displacement relationship. Since the second slope is flat (plastic yielding), the ratio with the elastic slope (**RATIO**) is also 0.

**EXP** is an internal exponent defining the transition from elastic to plastic state. A bi-linear (large exponent, small transition radius) is used. Smaller exponents would be used to define larger radius having more gradual transitions to plasticity.

**KE** = Effective linear stiffness as calculated in Attachment C (not part of Figure 4.1). Per SAP2000 manual **KE** is used for linear analyses. **KE** does not affect onset of nonlinear hysteretic behavior which utilizes **K**. The equations of motion and theoretical basis for the inter-relationship of **K** and **KE** in the modal time history method are provided in Attachments N and O.

The crane will roll when the rolling resistance (**YIELD**) is exceeded by the crane inertial forces.

**Table 4.3 Nonlinear Link/Support Element Properties**

| Component | Attribute | Value |
|---|---|---|
| Trolley Link Elements "TR1" and " TR2" | Rolling resistance (yield force)(1) | YIELD = 4.0 k/drive wheel |
| | Elastic body mode stiffness (2) | KE= 1 k / in / wheel |
| | Nonlinear curve elastic stiffness | K=500 k / in |
| | Stiffness ratio | RATIO = 0 |
| | Post-yield to elastic stiffness ratio | EXP = 20 |
| Bridge Link Elements "BR1" And "BR2" | Rolling resistance (yield force)(1) | YIELD = 8.0 k/drive wheel |
| | Elastic body mode stiffness (2) | KE= 3 k /I n / wheel |
| | Nonlinear curve elastic stiffness | K= 1,500 k/in |
| | Elastic to plastic transition | EXP=20 |
| | Post-yield to elastic stiffness ratio | RATIO = 0 |

(1) The wheel brake rolling resistance forces are calculated in Attachment B.

(2) The low frequency stiffness is calculated in Attachment C

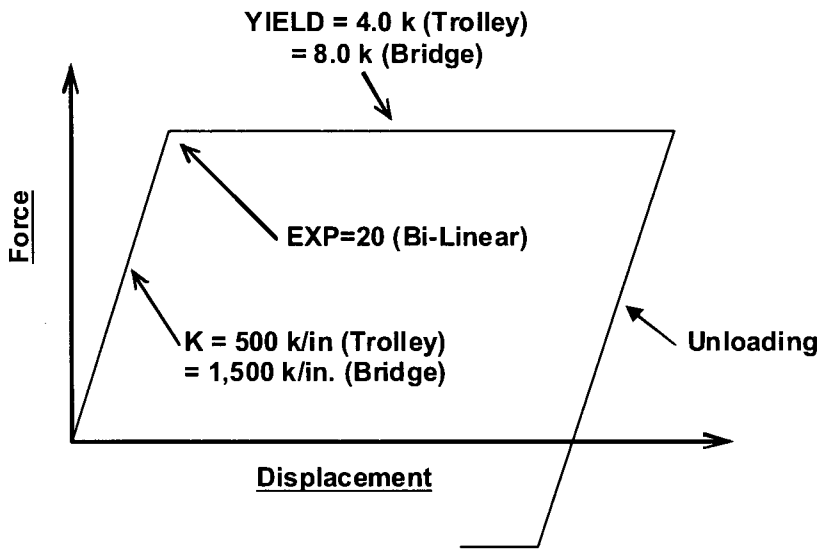


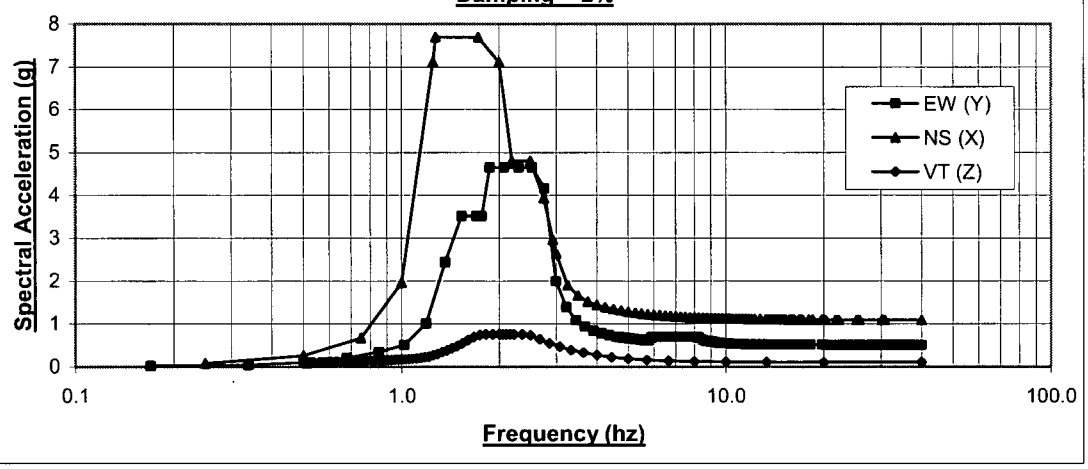

**Figure 4.1 Crane Drive Wheel Nonlinear Rolling Hysteretic Behavior**

## 4.6 Seismic Loading

### 4.6.1 Design Basis Earthquake (DBE) Response Spectra

The seismic loads are defined by the design basis response spectra applicable for the crane location in the Fuel Handling Building [7]. The design basis acceleration response spectra are shown in Figure 4.2.

**Figure 4.2 Cask Handling Crane Design Basis Response Spectra**
**Damping = 2%**



### 4.6.2 Acceleration Time Histories

The nonlinear seismic analyses, herein, uses acceleration time histories to define the input motion for the nonlinear analyses. The spectral composition of the time histories develop spectra that match the design spectra following USNRC NUREG-0800 Standard Review Plan guidelines [8]. The time histories used in the nonlinear analyses and their development is provided in [6].

Five sets of acceleration time histories are developed. Each set consists of two orthogonal horizontal and one vertical acceleration time histories. The acceleration time histories in each set are statistically mutually independent, having correlation coefficients of 0.16 or less [6].

A separate seismic analysis is conducted for each set of acceleration time histories.. Since the three time histories in a set are statistically independent, they are input simultaneously.

Table 4.4 lists the time histories used in the seismic analyses conducted herein.

**Table 4.4 Analysis Acceleration Time Histories**

| No. | Set No | Label | SAP200 | Cardinal |
|---|---|---|---|---|
| 1 | A1 | a1xNS | X | NS |
| 2 | | a1xEW | Y | EW |
| 3 | | a1xVT | Z | Vert |
| 4 | A2 | a2xNS | X | NS |
| 5 | | a2xEW | Y | EW |
| 6 | | a2xVT | Z | Vert |
| 7 | A3 | a3xNS | X | NS |
| 8 | | a3xEW | Y | EW |
| 9 | | a3xVT | Z | Vert |
| 10 | A4 | a4xNS | X | NS |
| 11 | | a4xEW | Y | EW |
| 12 | | a4xVT | Z | Vert |
| 13 | A5 | a5xNS | X | NS |
| 14 | | a5xEW | Y | EW |
| 15 | | a5xVT | Z | Vert |

Maximum absolute responses from each of the five time history sets are averaged following ASCE/SEI guidelines [9] and combined with dead and crane lift loadings to develop the design forces used in the structural qualification of the crane.

### 4.6.3 Damping

Damping used in the analyses for calculating the crane response uses the site licensing basis 2% of critical damping (0.02) for steel structures. [7].

## 4.7 Load Combination

For each of the 15 crane configurations, one static (dead loading of bridge, $P_{db}$, and trolley, $P_{dt}$ , and the Lifted Loading $P_{lr}$) and five time history analyses (sets A1-A5, $P_{e'}$) are conducted for which the peak maximum and minimum time history responses retained. The maximum absolute responses resulting from each of the five time history sets responses are averaged [9; Section 3.3.2] and then added and subtracted with the static dead and live loading response to develop the design loadings presented in Attachment D. NOG-1 [3] considers seismic load combinations to be Extreme Environmental loads.

**Table 4.5 Crane Load Combination**

| | |
|---|---|
| **Extreme Environmental Loads** | **ASME NOG-1: 2002, SECTION 4140 [3]**<br>$P_{C10} = P_{db} + P_{dt} + P_{lr}$ +/- Abs($P_{e'}$) |

## 5.0 CRANE MODEL

A linearly elastic, static finite element analysis is used to obtain Normal Operation member forces [2]. The seismic loads, in the analysis herein, are developed using a nonlinear modal time history analysis. The nonlinear effects are concentrated in the link elements that connecr the crane drive wheels with the rails.

The crane model follows the guidelines presented in NOG-1 (3):

a) The trolley assembly is modeled as a nearly rigid assembly.

b) The bridge girders, end ties and trucks are modeled as elastic beam elements having the section properties (cross-sectional areas, moments of inertia, e.g) developed in Attachment A. The beam elements are assigned densities to match the weights listed in Section 4.3.

c) Weights are assigned as concentrated forces for the trolley and lifted load and as material densities according to the values presented above in Sections 4.2 and 4.3.

d) Member lengths and elevations are taken from the general arrangement drawings [D1-D3].

e) The bridge finite elements follow the centerlines of the girders, end ties and trucks as shown in the General Arrangement Drawings[D1-D3]. Near rigid elements provide the vertical off-sets associated with the differences in centerline elevations. The trolley mass c.g. is 81 inches above the supporting bridge girder centerlines. The bridge centerline elevation is taken to be 0.

f) Member elevations are listed in Table 5.1:

**Table 5.1 Crane Model Elevations**

| Component | Model Elevation (in) |
|---|---|
| Trolley | +81 |
| Trolley wheels at rail | +56.25 |
| End tie centerlines | +47 |
| Truck centerlines | +15 |
| Bridge girder centerlines | 0 |
| Bridge wheels at rail | -1.5 |
| Main hook (raised) | -3 |
| Main hook (lowered) | -783 |
| Auxiliary hook (raised) | +9 |
| Auxiliary hook (lowered) | -763 |

### 5.1 Model Sketches

Sketches of the finite element model are presented in Figures 1 through 7. The sketches include:

a) Figure 1 – Overall model with trolley at mid-span
b) Figure 2 – Overall model with trolley at quarter-span
c) Figure 3 – Overall model with trolley at end-span
d) Figure 4 – Crane nodal point numbering
e) Figure 5 – Crane element numbering

### 5.2 Coordinate Systems.

SAP2000 uses both global and and local coordinate systems. Joint information is described using global coordinates. The model sketches above show the global system. Frame and Link/Support elements use a local coordinate system.The model systems are related to the Kewaunee plant system as follows:

### 5.2.1 Global System

The SAP2000 model global sytem as related to the Kewaunee plant system is shown in Table 5.2:

| Table 5.2 SAP2000 Model and Plant Global Coordinate Systems | |
|---|---|
| **SAP2000 Model** | **Kewaunee Station** |
| X | North - South |
| Y | East - West |
| Z | Vertical |

### 5.2.2 Local System for Frame Elements and Link/Support Elements

The frame (beam) elements and the linear and nonlinear link elements used in this model correspond to the numbers "1," "2'" and "3" for the local coordinate system.

| Table 5.3a SAP2000 Beam Local Coordinate System | |
|---|---|
| **SAP2000 Axes** | **Frame (Beam) Element (This Model)** |
| 1 | Along the direction of the beam. |
| 2 | Vertical for horizontal beams.<br>In "X" (N-S) global direction for vertical beams. |
| 3 | Normal to the "1-2" direction plane. |

| Table 5.3b SAP2000 Link/Support Local Coordinate System | |
|---|---|
| **SAP2000 Axes** | **Link/Support Element (This Model)** |
| 1 | Along the direction of the link for 2 joint links.<br>Vertical for single joint (support) links. |
| 2 | In "X" (N-S) global direction for vertical links |
| 3 | Normal to the "1-2" direction plane. |

### 5.2.3 Frame Element Output Descriptions

The member force output files presented in Attachment D list the shear forces and moments resulting from the analyses conducted. Table 5.4 describes the force attribute labels used by the SAP2000 program.

| Table 5.4 SAP2000 Frame Element Forces | |
|---|---|
| **SAP2000 Label** | **Force Description** |
| F1 | Axial Force |
| V2 | Vertical Shear Force |
| V3 | Horizontal Shear Force |
| T | Torsional Moment |
| M2 | Weak Axis Bending Moment |
| M3 | Strong Axis Bending Moment |

## 5.3 Boundary Conditions and Member End Releases

Boundary conditions are used to model the continuity of forces and moments through the model. Modeling is done by specifying base fixity conditions and beam element member end releases. The following items are modeled having special boundary conditions:

a) Bridge wheel/runway rail interfaces
b) Trolley wheel/runway rail interfaces

### 5.3.1 Bridge Wheel Connection to Runway Rail

The bridge end truck wheel boundary conditions with respect to the runway are modeled in accordance with the requirements of ASME NOG-1, Section 4153.6. Accordingly, the wheels on the South end of the crane are restrained transverse to the rail and are released on the North end. The drive wheels (two on trolley, two on bridge) are restrained parallel (in-line) to the rail using nonlinear link elements set to model the bridge rolling resistance (Attachment B). Table 5.5 lists the boundary restraints used for the bridge wheel/rail interfaces.

**Table 5.5 Bridge Wheel/Rail Boundary Restraints (1)**

| Wheel | Transverse to Rail (X; NS) | In-Line with Rail Y; (EW) | Vertical (Z; VT)I | R1 | R2 | R3 |
|---|---|---|---|---|---|---|
| South-East Drive (NP-10) | Fixed | Link – "BR1" (2) | Fixed | Free | Free | Free |
| South Idler (NP-11) | Fixed | Free | Fixed | Free | Free | Free |
| South Idler (NP-12) | Fixed | Free | Fixed | Free | Free | Free |
| South Idler (NP-13) | Fixed | Free | Fixed | Free | Free | Free |
| North-East Drive (NP-14) | Free | Link – "BR2" (2) | Fixed | Free | Free | Free |
| North Idler (NP-15) | Free | Free | Fixed | Free | Free | Free |
| North Idler (NP-16) | Free | Free | Fixed | Free | Free | Free |
| North Idler (NP-17) | Free | Free | Fixed | Free | Free | Free |

(1) All wheels are restrained vertically and all are released for rotation about all axes. SAP2000 global joint restraints are used for the non-drive wheels.
(2) SAP2000 Support elements are used to model the drive wheel rolling resistance.

### 5.3.2 Trolley Wheel Connection to Trolley Rail

The trolley wheel boundary conditions with the trolley rail are also modeled in accordance with requirements of ASME NOG-1, Section 4153.6. The trolley wheel connections to the supporting bridge girder are modeled using beam (frame) elements. Accordingly, the wheel boundary conditions are modeled using frame member end releases. The trolley drive wheels are restrained parallel (in-line) to the rail using nonlinear link elements having the yield set equal to the trolley rolling resistance (Attachment B).

Table 5.6 lists the boundary restraints used for the trolley wheel/rail interfaces.

**Table 5.6 Trolley Wheel/Rail Connection Restraints (1)**

| Wheel | Transverse to Rail (Y; E-W) | In-Line with Rail (X; N-S) | Vertical (Z; VT) | R1 | R2 | R3 |
|---|---|---|---|---|---|---|
| South-East Drive (NP-301) | Fixed | Link – "TR1" (2) | Fixed | Free | Free | Free |
| South-West Drive (NP302) | Fixed | Link – "TR2" (2) | Fixed | Free | Free | Free |
| North-East Idler (NP-401) | Fixed | Free | Fixed | Free | Free | Free |
| North-West Idler (NP-402) | Fixed | Free | Fixed | Free | Free | Free |

(1) All wheels are restrained vertically and all are released for rotation about all axes.
(2) SAP2000 Link elements are used to model the drive wheel rolling resistance.

## 6.0 ANALYSES CONDUCTED

### 6.1 Design Basis Analyses

Nonlinear time history analyses are conducted to develop member forces used for the seismic qualification of the crane (member forces, accelerations, displacements) for each of the configurations listed in Table 6.1 in accordance with NOG-1 requirements [3]. Each configuration analysis uses five independent time history sets, each set having three statistically independent time histories.

**Table 6.1 Crane Configurations Analyzed**

| Crane Configuration | Run ID | Trolley Position | Main Hoist Hook | | Auxiliary Hoist Hook | |
|---|---|---|---|---|---|---|
| | | | Position | Load | Position | Load |
| Case01 | midmhuwl | Mid-Span | Hook Up | With Load | Hook Up | No Load |
| Case02 | qrtmhuwl | Quarter-Span | Hook Up | With Load | Hook Up | No Load |
| Case03 | endmhuwl | End-Span | Hook Up | With Load | Hook Up | No Load |
| Case04 | midmhunl | Mid-Span | Hook Up | No Load | Hook Up | No Load |
| Case05 | qrtmhunl | Quarter-Span | Hook Up | No Load | Hook Up | No Load |
| Case06 | endmhunl | End-Span | Hook Up | No Load | Hook Up | No Load |
| Case07 | midmhdwl | Mid-Span | Hook Down | With Load | Hook Up | No Load |
| Case08 | qrtmhdwl | Quarter-Span | Hook Down | With Load | Hook Up | No Load |
| Case09 | endmhdwl | End-Span | Hook Down | With Load | Hook Up | No Load |
| Case10 | midahuwl | Mid-Span | Hook Up | No Load | Hook Up | With Load |
| Case11 | qrtahuwl | Quarter-Span | Hook Up | No Load | Hook Up | With Load |
| Case12 | endahuwl | End-Span | Hook Up | No Load | Hook Up | With Load |
| Case13 | midahdwl | Mid-Span | Hook Up | No Load | Hook Down | With Load |
| Case14 | qrtahdwl | Quarter-Span | Hook Up | No Load | Hook Down | With Load |
| Case15 | endahdwl | End-Span | Hook Up | No Load | Hook Down | With Load |

### 6.2 Parametric Analyses

A sensitivity study parametrically varying the nonlinear Link/Support parameters is conducted to demonstrate the nonlinear analyses are stable. Relatively large changes are made to the element input parameters and reseltant crane component member forces recorded and compared. Table 6.2 lists and describes the parametric studies conducted.

The parametric analyses are conducted for one time history set (Set A1, for X, Y, and Z directions) for the three crane configuration cases; Case-07, Case-08, and Case-09 (trolley at mid-, quarter-, and end-span, all with load on lowered main hoist hook).

**Table 6.2 Nonlinear Link/Support Element Parameter Sensitivity Analyses**

| Run No. | Parameter Variation |
|---|---|
| 1 | Best Estimate Values (see Table 4.4) |
| 2 | **KE** = **KE** / 2 |
| 3 | **KE** = **KE** x 2 |
| 4 | **K** = **K** / 2 |
| 5 | **K** = 2 x **K** |
| 6 | **EXP** = **EXP** / 2 |

Sensitivity analysis results are provided in Attachment M. An overall summary and discussion of results is provided in Section 8.3, below. These results are for information only, and not for design purposes since they may be bounded by the other analyses.

## 7.0 COMPUTER PROGRAM

The SAP2000 Version 11.0.1 computer program is used to perform the analyses. The program has been verified and validated in accordance with ACECO AP-20.5, "Computer Program Verification and Validation" [5]. The program used to conduct the analyses is installed on the Hewlett Packard computer, serial number 2UA5320KN9.

### 7.1 Computer Analysis Files

Three types of SAP2000 Files are used for conducting, checking and storing the analysis

#### 7.1.1 Analysis Input Text (.s2k) Files

These are text files that list all the input requirements for the analyses, including nodal point coordinates, material properties, element connectivity, boundary conditions and loading cases and combinations needed for the time history analyses. The text files (.s2k files) are read, translated and executed by the SAP2000 program. The input text files representing the fifteen trolley position and hook configurations are listed in Table 6.1 and presented in Attachment I. They are also included on a CD developed for this calculation.

#### 7.1.2 Analysis Model Run ".SDB" Files

These files contain the completed analysis. All analytical inputs and results are available when opened using the SAP2000 program, Version 11.0.1. The files are provided in the calculation CD.

#### 7.1.3 Analysis Output Files (EXCEL Format)

The SAP2000 program organizes all files (inputs or outputs to be stored as tables which can be directly exported into MS ACCESS or EXCEL files for review and further processing. The output files presented in the CD contain the following output results for all Load Cases, and for all loadings as listed at the end of the input files. The outputs listed in Table 8.1, below, are provided in the calculation CD.

## 8.0 ANALYSIS RESULTS

Table 8.1 summarizes the contents of the calculation/information/checking attachments. Attachments P and Q are added to assure that the program is correctly combining the loads associated with each case.

| Table 8.1 Calculation Attachments | | |
|---|---|---|
| **Attachment** | **Description** | **Purpose** |
| A | Bridge Section Properties | Analysis Input |
| B | Braked Wheel Rolling Forces | Analysis Input |
| C | Effective Elastic and Nonlinear Link Stiffness Values (**KE**, **K**) | Analysis Input |
| D | Member Forces | Design Output |
| E | Nodal Point Displacements | Design Output |
| F | Nodal Point Absolute Accelerations | Design Output |
| G | Joint Base Reactions | For Information/Design |
| H | Modal Frequencies and Mass Participation | For Information |
| I | Input text files (.s2k Files) | Analysis Input |
| J | Bridge Drive Girder Moment, Shear and Axial Force diagrams (Selected for Cases 7, 8, 9) | For Information |
| K | Trolley and Bridge Displacement Time Histories (for Case 7) | For Information |
| L | Trolley Nonlinear Link Hysteresis Response Loop | For Information |
| M | Nonlinear Link Element Parametric Sensitivity Analyses (for Case 7) | For Information |
| N | SAP2000 Theoretical Basis for Nonlinear Modal Time History Analyses | For Information |
| O | SAP2000 Theoretical Basis for Nonlinear Link/Support Elements | For Information |
| P | Load Combination Check – Crane Frame Element Forces | For Information |
| Q | Load Combination Check – Crane Relative Displacements | For Information |

Table 8.2 lists the complete information (all load cases and loadings) printed to a CD. This information can be retrieved, as needed.

| Table 8.2 Computer Analyses Results on Electronic Media | |
|---|---|
| **Appendix (on CD)** | **Description** |
| 1 | SAP2000 ".s2k" input files. |
| 2 | Acceleration Time Histories |
| 3 | SAP2000 ".SDB" analysis files. |
| 4 | Output files in EXCEL format. Each file contains;<br>a) Link/support element forces<br>b) Link/support element deformations<br>c) Frame element member forces<br>d) Joint relative displacements<br>e) Joint absolute accelerations<br>f) Support (base) reactions<br>g) Modal frequencies and mass participation |

### 8.1 Member Force Output

Design member forces used for the subsequent crane stress qualification are presented in Attachment D. The forces presented consist of the maximum combined dead load, live (lifted) and seismic loads of the NOG-1 load combinations:

$$F_{max} = 1.0\ DL + 1.0\ LL + 1.0\ Abs(EQ)$$

$$F_{min} = 1.0\ DL + 1.0\ LL - 1.0\ Abs(EQ)$$

More detailed design output is available on the analysis CD.

Tables 8.3a-c list the maximum enveloped design forces for the 15 load configurations analyzed for the bridge girders, end ties, and trucks, respectively.

**Table 8.3a Girder Member Forces**

| Frame | Case | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|
| Component | No | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| Girders | C01 | MAX: | 79 | 163 | 11 | 540 | 2,418 | 61,446 |
| Girders | C02 | MAX: | 79 | 200 | 11 | 508 | 2,605 | 39,180 |
| Girders | C03 | MAX: | 80 | 120 | 10 | 454 | 2,561 | 17,279 |
| Girders | C04 | MAX: | 78 | 62 | 12 | 582 | 2,503 | 20,884 |
| Girders | C05 | MAX: | 79 | 79 | 11 | 480 | 2,562 | 15,718 |
| Girders | C06 | MAX: | 81 | 59 | 10 | 452 | 2,467 | 9,677 |
| Girders | C07 | MAX: | 78 | 191 | 12 | 581 | 2,555 | 72,675 |
| Girders | C08 | MAX: | 80 | 244 | 11 | 469 | 2,583 | 47,824 |
| Girders | C09 | MAX: | 80 | 138 | 10 | 436 | 2,458 | 19,959 |
| Girders | C10 | MAX: | 77 | 70 | 12 | 570 | 2,476 | 25,271 |
| Girders | C11 | MAX: | 80 | 92 | 11 | 471 | 2,549 | 19,498 |
| Girders | C12 | MAX: | 80 | 72 | 10 | 432 | 2,531 | 11,024 |
| Girders | C13 | MAX: | 78 | 71 | 12 | 557 | 2,535 | 25,987 |
| Girders | C14 | MAX: | 80 | 92 | 11 | 464 | 2,568 | 19,300 |
| Girders | C15 | MAX: | 81 | 71 | 9 | 440 | 2,446 | 11,020 |
| | | MAX: | 81 | 244 | 12 | 582 | 2,605 | 72,675 |

**Table 8.3b End Tie Member Forces**

| Frame | Case | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|
| Component | No | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| End Ties | C01 | MAX: | 12 | 2 | 15 | 0 | 1,743 | 93 |
| End Ties | C02 | MAX: | 12 | 2 | 22 | 0 | 2,613 | 67 |
| End Ties | C03 | MAX: | 14 | 2 | 22 | 0 | 2,566 | 73 |
| End Ties | C04 | MAX: | 12 | 2 | 15 | 0 | 1,845 | 88 |
| End Ties | C05 | MAX: | 12 | 2 | 22 | 0 | 2,568 | 97 |
| End Ties | C06 | MAX: | 11 | 2 | 21 | 0 | 2,468 | 69 |
| End Ties | C07 | MAX: | 13 | 2 | 16 | 0 | 1,876 | 86 |
| End Ties | C08 | MAX: | 13 | 2 | 21 | 0 | 2,588 | 81 |
| End Ties | C09 | MAX: | 16 | 2 | 21 | 0 | 2,456 | 67 |
| End Ties | C10 | MAX: | 14 | 1 | 16 | 0 | 1,874 | 64 |
| End Ties | C11 | MAX: | 13 | 2 | 21 | 0 | 2,552 | 74 |
| End Ties | C12 | MAX: | 11 | 2 | 21 | 0 | 2,533 | 67 |
| End Ties | C13 | MAX: | 11 | 2 | 16 | 0 | 1,875 | 81 |
| End Ties | C14 | MAX: | 12 | 2 | 21 | 0 | 2,572 | 86 |
| End Ties | C15 | MAX: | 10 | 2 | 20 | 0 | 2,444 | 68 |
| | | MAX: | 16 | 2 | 22 | 0 | 2,613 | 97 |

| Table 8.3c Truck Member Forces | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frame | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Component | No | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| Trucks | C01 | MAX: | 22 | 90 | 52 | 883 | 1,879 | 3,215 |
| Trucks | C02 | MAX: | 23 | 109 | 52 | 878 | 1,869 | 3,891 |
| Trucks | C03 | MAX: | 20 | 121 | 51 | 863 | 1,835 | 4,255 |
| Trucks | C04 | MAX: | 22 | 42 | 50 | 845 | 1,795 | 1,461 |
| Trucks | C05 | MAX: | 22 | 52 | 55 | 925 | 1,985 | 1,779 |
| Trucks | C06 | MAX: | 19 | 55 | 52 | 883 | 1,884 | 1,945 |
| Trucks | C07 | MAX: | 25 | 103 | 50 | 845 | 1,792 | 3,688 |
| Trucks | C08 | MAX: | 24 | 133 | 54 | 904 | 1,943 | 4,753 |
| Trucks | C09 | MAX: | 20 | 139 | 52 | 875 | 1,872 | 4,928 |
| Trucks | C10 | MAX: | 26 | 46 | 50 | 843 | 1,793 | 1,608 |
| Trucks | C11 | MAX: | 23 | 57 | 54 | 907 | 1,948 | 1,956 |
| Trucks | C12 | MAX: | 20 | 62 | 53 | 894 | 1,903 | 2,182 |
| Trucks | C13 | MAX: | 22 | 47 | 51 | 858 | 1,823 | 1,612 |
| Trucks | C14 | MAX: | 22 | 57 | 55 | 905 | 1,970 | 2,028 |
| Trucks | C15 | MAX: | 18 | 63 | 53 | 890 | 1,892 | 2,181 |
| | | MAX: | 26 | 139 | 55 | 925 | 1,985 | 4,928 |

## 8.2 Parametric Sensitivity Analyses

The parametric analysis of the Link/Support input parameters are conducted for the Case 7 loading configuration using the A1 set of time histories. Member force responses to each of the six analyses listed in Table 6.2 are provided in Attachment M. The maximum crane component member force responses for each analysis are listed in Table 8.4a.

The member force percentage variation associated with each analysis with respect to the "Best Estimate" analysis is presented in Table 8.4b.

| Table 8.4a Parametric Analyses – Governing Member Force Response | | | | | | | |
|---|---|---|---|---|---|---|---|
| Link/Support Attribute Variation | Crane Component | P | V2 | V3 | T | M2 | M3 |
| | | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| Best Estimate Values (for all parameters) (BE) | Girders | 75 | 190 | 12 | 564 | 2,462 | 72,540 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,766 | 86 |
| | Trucks | 25 | 105 | 46 | 772 | 1,644 | 3,737 |
| Ke = Ke / 2 (KE-LB) | Girders | 74 | 190 | 12 | 562 | 2,463 | 72,545 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,766 | 87 |
| | Trucks | 25 | 105 | 46 | 771 | 1,644 | 3,734 |
| Ke = Ke x 2 (KE-UB) | Girders | 75 | 190 | 12 | 566 | 2,466 | 72,536 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,764 | 86 |
| | Trucks | 25 | 105 | 46 | 772 | 1,644 | 3,738 |
| K = K / 2 (K-LB) | Girders | 73 | 190 | 12 | 578 | 2,545 | 72,555 |
| | End-Ties | 11 | 2 | 15 | 0 | 1,735 | 82 |
| | Trucks | 23 | 105 | 46 | 770 | 1,648 | 3,735 |
| K = 2 x K (K-UB) | Girders | 77 | 191 | 12 | 553 | 2,510 | 72,492 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,765 | 84 |
| | Trucks | 24 | 105 | 45 | 763 | 1,618 | 3,757 |
| EXP = EXP / 2 (EXP-LB) | Girders | 75 | 190 | 12 | 564 | 2,460 | 72,539 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,765 | 86 |
| | Trucks | 25 | 105 | 46 | 772 | 1,645 | 3,736 |

| Table 8.4b Parametric Analyses – Response Variation w.r.t. Best Estimate Response ( % ) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Link/Support Attribute Variation | Crane Component | P | V2 | V3 | T | M2 | M3 |
| | | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| Best Estimate Values (for all parameters) (BE) | Girders | 0 | 0 | 0 | 0 | 0 | 0 |
| | End-Ties | 0 | 0 | 0 | 0 | 0 | 0 |
| | Trucks | 0 | 0 | 0 | 0 | 0 | 0 |
| Ke = Ke / 2 (KE-LB) | Girders | -0.3 | 0.0 | -0.1 | -0.3 | 0.0 | 0.0 |
| | End-Ties | 0.5 | 0.3 | 0.0 | 0.0 | 0.0 | 0.4 |
| | Trucks | 0.4 | -0.1 | 0.0 | -0.1 | 0.0 | -0.1 |
| Ke = Ke x 2 (KE-UB) | Girders | 0.2 | 0.0 | 0.1 | 0.4 | 0.2 | 0.0 |
| | End-Ties | -0.7 | -0.3 | -0.1 | 0.0 | -0.1 | -0.3 |
| | Trucks | -0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| K = K / 2 (K-LB) | Girders | -2.1 | -0.1 | 3.1 | 2.5 | 3.4 | 0.0 |
| | End-Ties | -10.9 | -4.0 | -2.0 | 0.0 | -1.8 | -5.5 |
| | Trucks | -8.1 | 0.0 | 0.2 | -0.1 | 0.2 | 0.0 |
| K = 2 x K (K-UB) | Girders | 2.9 | 0.2 | 1.3 | -2.0 | 2.0 | -0.1 |
| | End-Ties | -6.4 | -1.7 | 0.4 | 0.0 | -0.1 | -3.1 |
| | Trucks | -4.1 | 0.5 | -1.6 | -1.2 | -1.6 | 0.5 |
| EXP = EXP / 2 (EXP-LB) | Girders | 0.0 | 0.0 | -0.1 | -0.1 | -0.1 | 0.0 |
| | End-Ties | -1.0 | 0.0 | 0.0 | 0.0 | -0.1 | 0.0 |
| | Trucks | -0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

### 8.2.1 Stiffness Variation Discussion

The above tables show that the analysis is stable with regard to the Link/Support Element stiffness variations of **K** and the effective linear elastic stiffness **Ke**. The member response due to the doubling and halving of the stiffness values results in generally less than 5% change in response. The exception is the variation (~11%) associated with the axial forces in the trucks when the **K** parameter is halved. In this case, the axial force decreased from 25 k to 23 k, and the 2 k difference will have a relatively small stress effect when compared with the significantly larger shear and moment forces.

Reducing the **EXP** parameter by a factor of two has no significant effect.

## 9.0 CONCLUSIONS

This calculation develops the Kewaunee Auxiliary Building Crane seismic design forces for the structural qualification of the crane trolley and bridge.

The seimic forces are developed using a nonlinear modal time history analysis of a finite element model of the crane. Uni-axial nonlinear link/support elements are used to model crane trolley and bridge rolling.

The analysis approach uses the verified SAP2000 computer program and follows the guidelines set forth in the SAP2000 analysis reference manual.

The crane is modeled according to NOG-1 [3] requirements, with the exception of the nonlinear link elements which connect the trolley and bridge braked drive wheels to their respective rails

The 15 load configurations analyzed follow ASCE/SEI 43-05 guidelines using 5 sets of acceleration time histories, each having 3 statistically independent time histories.

Complete inputs are provided in Attachment I. Summarized design outputs, member forces, joint relative displacements and absolute accelerations are provided in Attachments D-F. Complete output, including responses for each set of input time histories, are provided on CD.

Parametric studies are conducted (Attachment M) to demonstrate model stability when key nonlinear input parameters are varied.

Load combination checks are made in Attachments P and Q to assure that the seismic design forces (moments, shears, etc.) and displacements are correctly averaged and combined with the dead and live loadings.

This calculation follows all the guidelines and standards, as referenced below, to assure that correct and conservative results are obtained to structurally qualify the crane for postulated seismic event.

## 10.0 REFERENCES

### 10.1 Drawings

[D1] D-20776-001 – Single Failure Proof Trolley #2949 – General Arrangement – Elevation View.

[D2] D-20776-002 – Single Failure Proof Trolley #2949 – General Arrangement – Plan View.

[D3] D-20776-300 – Single Failure Proof Trolley #2949 – Trolley Arrangement – Plan View.

### 10.2 Documents


[1] OCDEK-20776-020, "PO70153249, Change Order 08, March 14, 2008.

[2] CAL-20776-SE-001,R3, "Single-Failure-Proof Upgrade of the Auxiliary Building Crane," ACECO Calculation.

[3] ASME NOG-1-2004, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder," American National Standard Institute, 2002.

[4] CSI Analysis Reference Manual for SAP2000, ETABS and SAFE, Dated January 2007, Computers and Structures, Inc. Berkeley, California.

[5] AP-20.5, Rev. 1, "Computer Program Control and Documentation," ACECO Design Procedure, December, 2001.

[6] ABS Calculation 1886592-C-001, R0,"Generation of Artificial Time Histories for the Fuel Cask Bridge Crane at the Kewaunee Power Station," May, 2008.

[7] DCR-3629-11, "Design basis Earthquake Response Spectra," Dominion Design Information Transmittal, March 25, 2008.

[8] NUREG-0800, Revision 3, "USNRC Standard Review Plan," U.S. Nuclear Regulatory Commission, March, 2007.

[9] ASCE/SEI 43-05, "Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities," American Society of Civil Engineers, 2005.

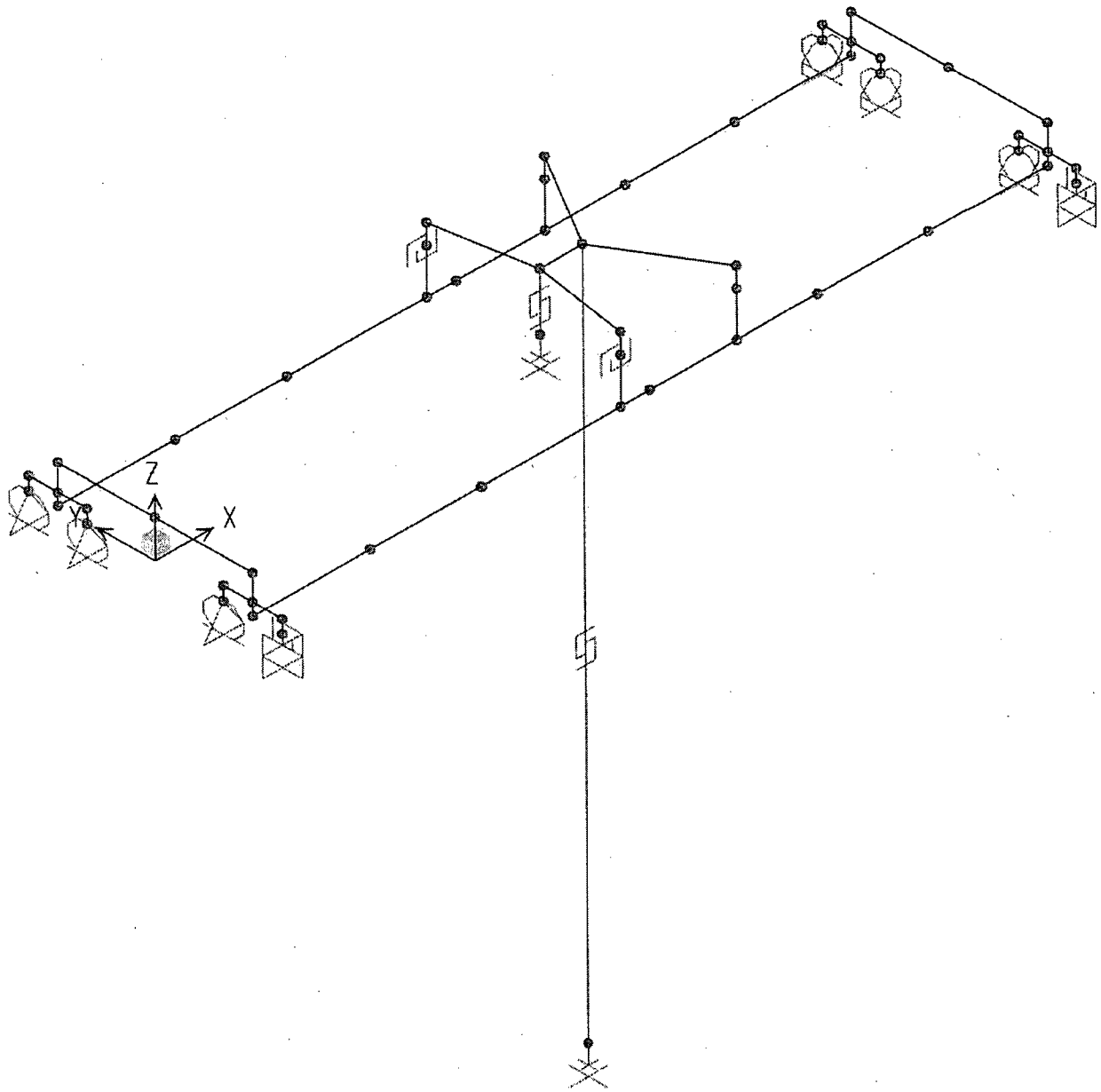



**Figure 1 Trolley at Mid-Span**

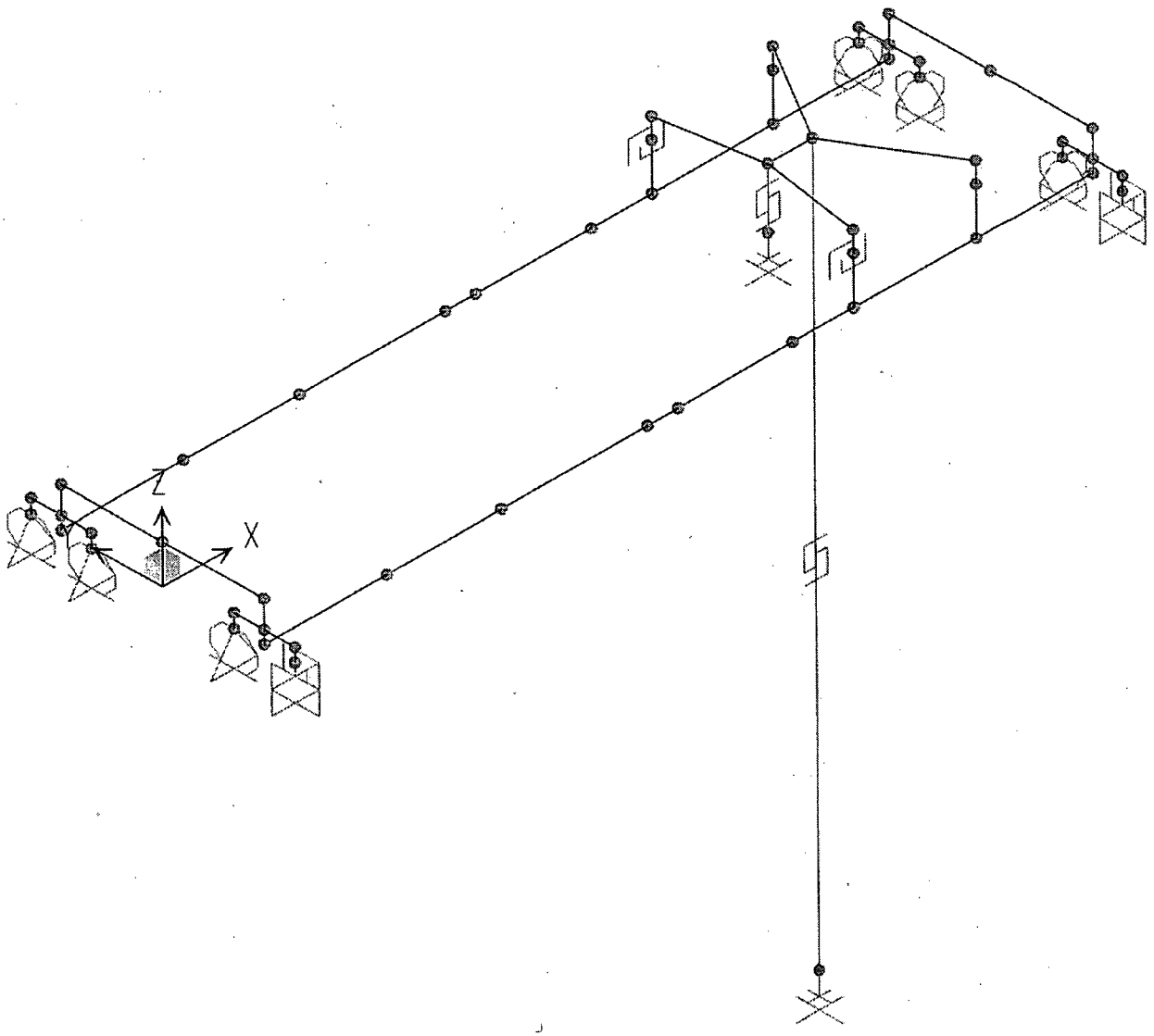



**Figure 2 Trolley at Quarter-Span**

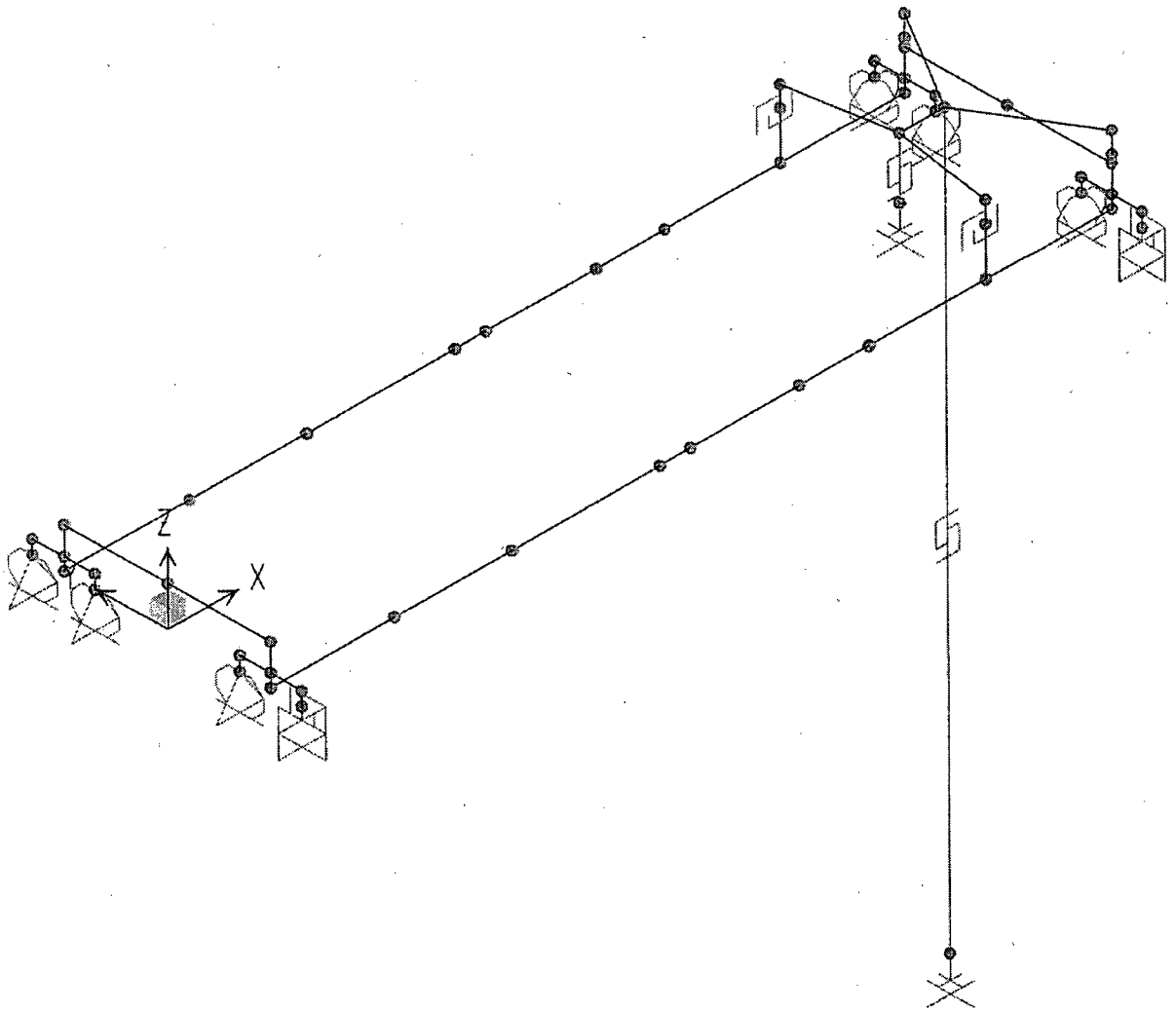



**Figure 3 Trolley at End-Span**

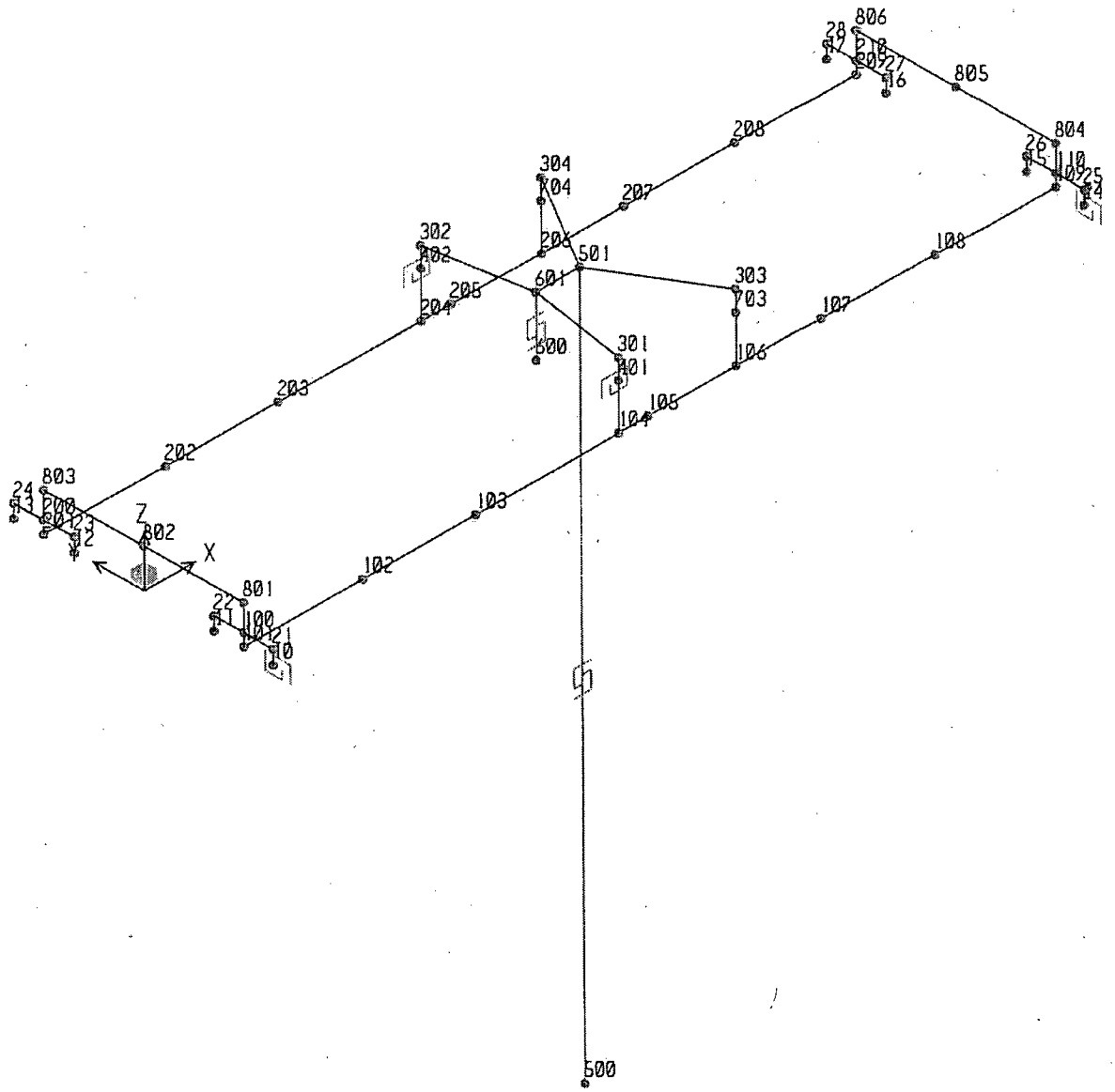



**Figure 4 Crane Nodal Points**

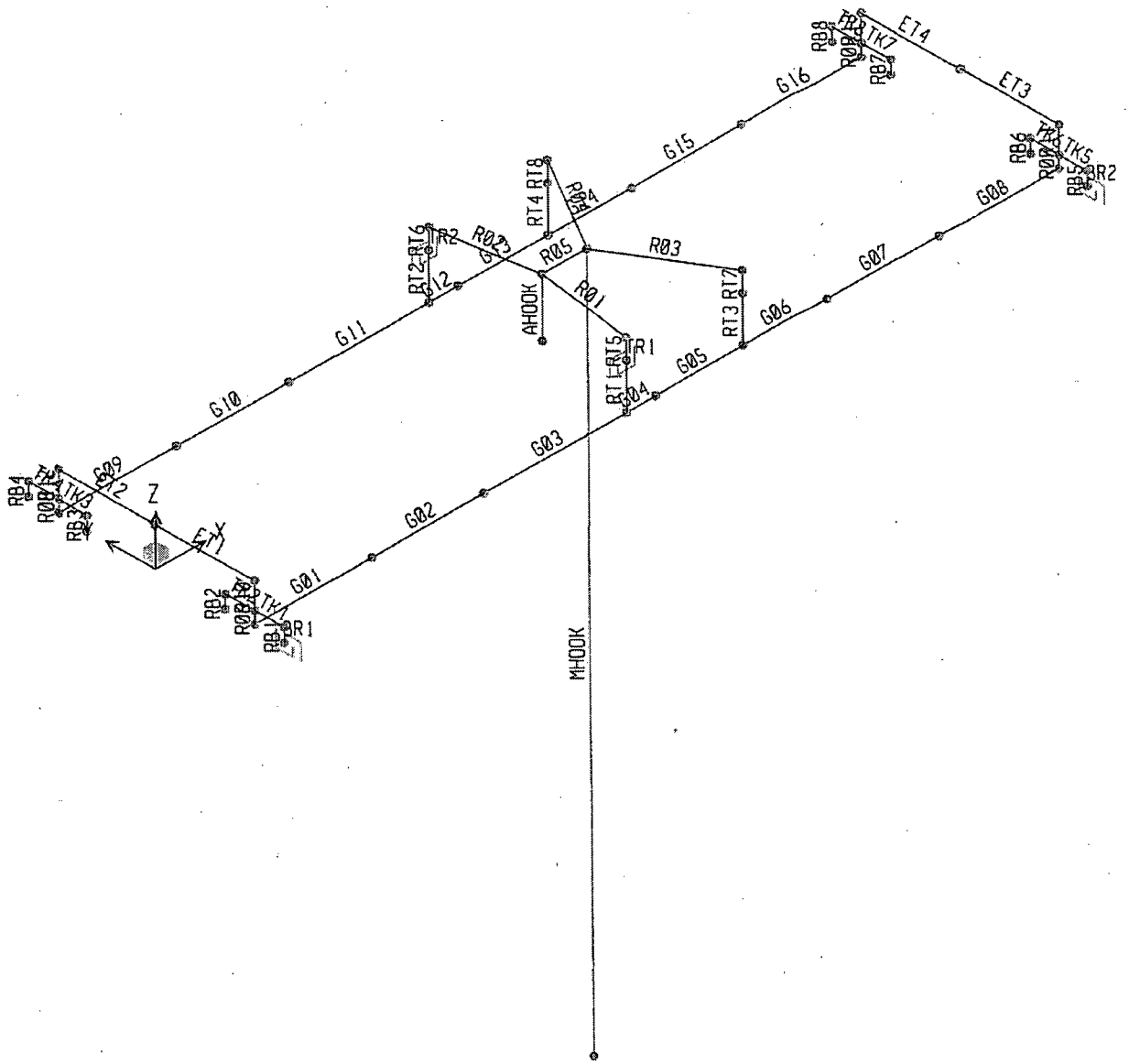



**Figure 5 Crane Elements**

**CAL-20776-SE-007**
**CRANE NON-LINEAR SEISMIC ANALYSES**
**ATTACHMENT A**
**BRIDGE SECTION PROPERTIES**

## A.1.0 PURPOSE AND SCOPE

The purpose of this calculation is to develop the Kewaunee Cask Handling Crane section properties to be used as inputs to the crane finite element model (FEM) non-linear seismic analyses.

A.4.1 - Bridge Girders ("EG" and "WG")
A.4.2 - Bridge Trucks ("TK")
A.4.3 - Bridge End-Tie ("ET")

Subsequent member stress evaluations may use more refined properties and details than presented herein (e.g. connections, member discontinuities, varying section properties, buckling).

The section properties are derived from the dimensions on the project drawings referenced in Section A.3.0, below.

## A.2.0 UNITS

$k := 1000 \cdot lbf$ $\quad$ $ksi = 1000\,psi$

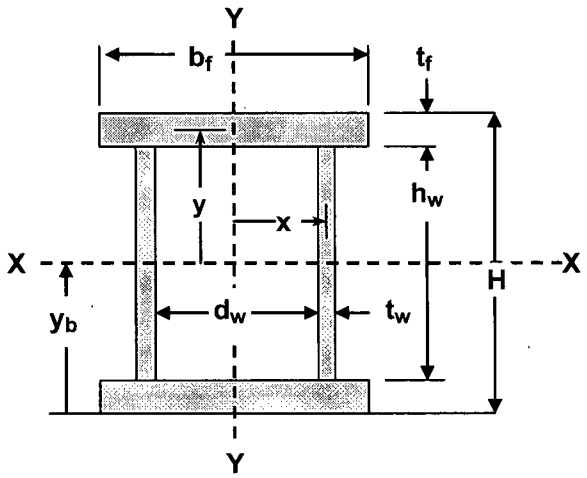
## A.3.0 REFERENCE DRAWINGS

[A1] U-53621; Whiting Drawing for Bridge Girders
[A2] U-60885; Whiting Drawing for Bridge End Trucks
[A3] T-49144; Whiting Drawing for Bridge End Ties

## A4.0 CALCULATIONS

In the following calculations, the "X-X" axis in the sketches conforms to the SAP2000 analysis "3-3" axis. The "Y-Y" axis conforms to the SAP2000 "2-2" axis.

## A.4.1 Bridge Girders - SAP Model Sections "EG" and "WG"




Symmetric Girder Section Dimensions [A1]

$b_f := 24.0 \cdot in$ $\quad t_f := 1.0 \cdot in$

$d_w := 20.0 \cdot in$ $\quad h_w := 97.0 \cdot in$ $\quad t_w := \frac{5}{16} \cdot in$

$H := h_w + 2 \cdot t_f$ $\quad H = 99.0 \cdot in$

$a_f := b_f \cdot t_f$ $\quad a_f = 24 \cdot in^2$

$a_w := h_w \cdot t_w$ $\quad a_w = 30.3 \cdot in^2$

$y_b := 0.5 \cdot H$ $\quad y_b = 49.5 \cdot in$

$x := 0.5 \cdot (d_w + t_w)$ $\quad x = 10.16 \cdot in$

$y := y_b - 0.5 \cdot t_f$ $\quad y = 49 \cdot in$

Calculate Cross-Section Area: $\quad A_{gr} := 2 \cdot a_f + 2 \cdot a_w = 108.625 \cdot in^2$

Calculate Shear Areas: $\quad As2_{gr} := 0.85 \cdot 2 \cdot a_w = 51.531 \cdot in^2$

$As3_{gr} := 0.85 \cdot 2 \cdot a_f = 40.8 \cdot in^2$

Calculate Torsional Constant: $\quad J_{gr} := \frac{2 \cdot t_f \cdot t_w \cdot (2 \cdot x)^2 \cdot (2 \cdot y)^2}{2 \cdot x \cdot t_w + 2 \cdot y \cdot t_f} = 23734.3 \cdot in^4$

Calculate Moments of Inertia:

Flange: $\quad ix_f := \frac{1}{12} \cdot b_f \cdot t_f^3 = 2 \cdot in^4$ $\quad iy_f := \frac{1}{12} \cdot t_f \cdot b_f^3 = 1152 \cdot in^4$

Web: $\quad ix_w := \frac{1}{12} \cdot t_w \cdot h_w^3 = 23767.5 \cdot in^4$ $\quad iy_w := \frac{1}{12} \cdot h_w \cdot t_w^3 = 0.2 \cdot in^4$

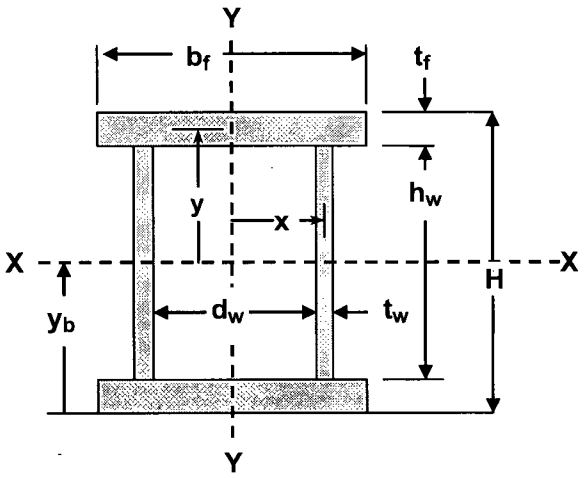
$I33_{gr} := 2 \cdot ix_f + 2 \cdot a_f \cdot y^2 + 2 \cdot ix_w = 162787.1 \cdot in^4$

$I22_{gr} := 2 \cdot iy_f + 2 \cdot a_w \cdot x^2 + 2 \cdot iy_w = 8557.9 \cdot in^4$

Calculate Section Moduli for Flange: $\quad S33_{f_gr} := \frac{I33_{gr}}{y_b} = 3288.6 \cdot in^3$

$S22_{f_gr} := \frac{I22_{gr}}{0.5 \cdot b_f} = 713.2 \cdot in^3$

## A.4.2 Bridge Trucks - SAP Model Sections "TK"




Symmetric Girder Section Dimensions [A2]

$b_f := 19.0 \cdot in$ $\quad t_f := 0.75 \cdot in$

$d_w := 8.5 \cdot in$ $\quad h_w := 25.375 \cdot in$ $\quad t_w := \frac{1}{2} \cdot in$

$H := h_w + 2 \cdot t_f$ $\quad H = 26.9 \cdot in$

$a_f := b_f \cdot t_f$ $\quad a_f = 14.25 \cdot in^2$

$a_w := h_w \cdot t_w$ $\quad a_w = 12.7 \cdot in^2$ $\quad t_w = 0.5 \cdot in$

$y_b := 0.5 \cdot H$ $\quad y_b = 13.438 \cdot in$

$x := 0.5 \cdot (d_w + t_w)$ $\quad x = 4.50 \cdot in$

$y := y_b - 0.5 \cdot t_f$ $\quad y = 13.063 \cdot in$

Calculate Cross-Section Area: $\quad A_{tk} := 2 \cdot a_f + 2 \cdot a_w = 53.875 \cdot in^2$

Calculate Shear Areas: $\quad As2_{tk} := 0.85 \cdot 2 \cdot a_w = 21.569 \cdot in^2$

$As3_{tk} := 0.85 \cdot 2 \cdot a_f = 24.225 \cdot in^2$

Calculate Torsional Constant: $\quad J_{tk} := \frac{2 \cdot t_f \cdot t_w \cdot (2 \cdot x)^2 \cdot (2 \cdot y)^2}{2 \cdot x \cdot t_w + 2 \cdot y \cdot t_f} = 1720.9 \cdot in^4$

Calculate Moments of Inertia:

Flange: $\quad ix_f := \frac{1}{12} \cdot b_f \cdot t_f^3 = 0.7 \cdot in^4$ $\quad iy_f := \frac{1}{12} \cdot t_f \cdot b_f^3 = 428.7 \cdot in^4$

Web: $\quad ix_w := \frac{1}{12} \cdot t_w \cdot h_w^3 = 680.8 \cdot in^4$ $\quad iy_w := \frac{1}{12} \cdot h_w \cdot t_w^3 = 0.3 \cdot in^4$

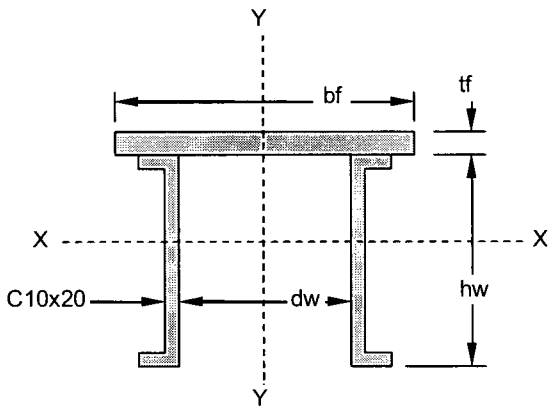
$I33_{tk} := 2 \cdot ix_f + 2 \cdot a_f \cdot y^2 + 2 \cdot ix_w = 6225.8 \cdot in^4$

$I22_{tk} := 2 \cdot iy_f + 2 \cdot a_w \cdot x^2 + 2 \cdot iy_w = 1371.7 \cdot in^4$

Calculate Section Moduli for Flange: $\quad S33_{f_tk} := \frac{I33_{tk}}{y_b} = 463.3 \cdot in^3$

$S22_{f_tk} := \frac{I22_{tk}}{0.5 \cdot b_f} = 144.4 \cdot in^3$

## A.4.3 Bridge End Ties SAP Model Sections "ET"




End Tie Section Dimensions [A3]

$b_f := 28 \cdot in$ $\quad t_f := 0.75 \cdot in$

$d_w := 21.5 \cdot in$ $\quad h_w := 10 \cdot in$ $\quad t_w := \frac{3}{8} \cdot in$

$H := h_w + t_f$ $\quad H = 10.8 \cdot in$

$a_f := b_f \cdot t_f = 21 \cdot in^2$

$a_w := 5.87 \cdot in^2$ (channel)

Calculate Cross-Section Area: $A_{et} := a_f + 2 \cdot a_w = 32.7 \cdot in^2$

Calculate Shear Areas: $As2_{et} := 0.85 \cdot 2 \cdot a_w = 10.0 \cdot in^2$

$As3_{et} := 0.85 \cdot 2 \cdot a_f = 0.2\, ft^{2.0}$

Calculate Torsional Constant: $J_{et} := \frac{b_f \cdot t_f^3}{3} + 2 \cdot 0.368 \cdot in^4 = 4.7 \cdot in^4$

Calculate Moments of Inertia: $y_b := \frac{2 \cdot a_w \cdot \frac{h_w}{2} + a_f \cdot \left(h_w + \frac{t_f}{2}\right)}{A_{et}} = 8.45 \cdot in$

Flange: $ix_f := \frac{1}{12} \cdot b_f \cdot t_f^3 = 0.98 \cdot in^4$ $\quad iy_f := \frac{1}{12} \cdot t_f \cdot b_f^3 = 1372.0 \cdot in^4$

Channels: $ix_w := 78.9 \cdot in^4$ $\quad iy_w := 2.80 \cdot in^4$

$x_{ch} := 0.606 \cdot in$ $\quad y_{ch} := \frac{h_w}{2} = 5 \cdot in$ $\quad y_{fl} := h_w + \frac{t_f}{2} = 10.38 \cdot in$

$$I33_{et} := ix_f + a_f \cdot (y_b - y_{fl})^2 + 2 \cdot ix_w + 2 \cdot a_w \cdot (y_b - y_{ch})^2 = 376.338 \cdot in^4$$

$$I22_{et} := iy_f + 2 \cdot a_w \cdot \left(\frac{d_w}{2} + x_{ch}\right)^2 + 2 \cdot iy_w = 2891.6 \cdot in^4$$

Calculate Section Moduli for Flange:

Flange: $S22_{f_et} := \frac{I22_{et}}{0.5 \cdot b_f} = 206.541 \cdot in^3$ $\quad S33_{f_et} := \frac{I33_{et}}{y_b} = 44.55 \cdot in^3$

**A5.0 SUMMARY OF UPDATED PROPERTIES** The properties are summarized in the SAP2000v11 format order.

**A.5.1 Bridge Girders**
**SAP Sections "EG" and "WG"**

$A_{gr} = 108.63 \cdot in^2$

$J_{gr} = 23734.3 \cdot in^4$

$I33_{gr} = 162787.1 \cdot in^4$

$I22_{gr} = 8557.9 \cdot in^4$

$As2_{gr} = 51.53 \cdot in^2$

$As3_{gr} = 40.80 \cdot in^2$

**A.5.2 Bridge Trucks**
**Sap Sections "TK"**

$A_{tk} = 53.88 \cdot in^2$

$J_{tk} = 1720.9 \cdot in^4$

$I33_{tk} = 6225.8 \cdot in^4$

$I22_{tk} = 1371.7 \cdot in^4$

$As2_{tk} = 21.57 \cdot in^2$

$As3_{tk} = 24.22 \cdot in^2$

**A.5.3Bridge End Ties**
**Sap Sections "ET"**

$A_{et} = 32.74 \cdot in^2$

$J_{et} = 4.7 \cdot in^4$

$I33_{et} = 376.3 \cdot in^4$

$I22_{et} = 2891.6 \cdot in^4$

$As2_{et} = 9.98 \cdot in^2$

$As3_{et} = 35.70 \cdot in^2$

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**CRANE NON-LINEAR SEISMIC ANALYSES**
**ATTACHMENT B**
**BRAKED WHEEL ROLLING FORCES**

## B.1 PURPOSE

The purpose of this calculation is to develop the forces required at the braked crane drive wheels that would overcome the set brake holding capacity. The crane brakes are preloaded spring brakes that are set when an earthquake occurs or when not in service. The constant set spring force on the brake disk develops the brake static torque. The wheel brake force is the force, if applied to the wheel rim that would exceed the torque rating.

When seismic inertial forces at the drive wheels exceed the braked torque the crane is postulated to roll with constant resistance in the non-linear analyses.

Braked wheel forces are calculated for the bridge drive wheels and the trolley drive wheels.

## B.2 UNITS

$k := 1000 \cdot lbf \quad ksi = 1000\,psi$

## B.3 REFERENCES

[B1] CAL_20776-ME-250-R2, Bridge Drive System
[B2] CAL_20776-ME-350-R2, Trolley Drive System

## B.4 DESIGN INPUTS

### B.4.1 Bridge Drive [B1]

Bridge Brake Torque Rating: $BT_{br} := 75 \cdot ft \cdot lbf$

Gear Box Ratio: $Rgb1_{br} := 36.7$ (bridge center gear box)

$Rgb2_{br} := 4.63$ (gear boxes at drive wheels)

Gear Efficiency: $e_{br} := 0.913$ (overall drive system)

Bridge Drive Wheel Diameter: $D_{br} := 27 \cdot in$

### B.4.2 Trolley Drive [B2]

Trolley Brake Torque Rating: $BT_{tr} := 88 \cdot in \cdot lbf$

Gear Box Ratio: $Rgb_{tr} := 228.93$ (gear boxes at drive wheels)

Gear Efficiency: $e_{tr} := 0.97$ (overall drive system)

Trolley Drive Wheel Diameter: $D_{tr} := 21 \cdot in$

## B.5 CALCULATIONS

The torque available at the wheels is calculated based on the brake torque, gearing ratios and efficiency. The available wheel force at the rail is the available torque divided by the wheel radius

### B.5.1 Bridge Drive Wheel Torque

$$WT_{br} := BT_{br} \cdot Rgb1_{br} \cdot Rgb2_{br} \cdot \frac{1}{e_{br}} = 13.958 \cdot ft \cdot k$$

### B.5.2 Bridge Drive Wheel Braked Force

$$F_{br} := \frac{WT_{br}}{\frac{D_{br}}{2}} = 12.408 \cdot k$$

### B.5.3 Trolley Drive Wheel Torque

$$WT_{tr} := BT_{tr} \cdot Rgb_{tr} \cdot \frac{1}{e_{tr}} = 1.731 \cdot ft \cdot k$$

### B.5.4 Trolley Drive Wheel Braked Force

$$F_{tr} := \frac{WT_{tr}}{\frac{D_{tr}}{2}} = 1.978 \cdot k$$

## B.6 CONCLUSIONS

### B.6.1 Bridge Drive Braked Wheel Design Force

The bridge drive is directly connected to both drive wheels. For design purposes, the bridge wheel resistance is increased by 25%.

$nw_{br} := 2$ $\quad Fdes_{br} := \frac{1.25F_{br}}{nw_{br}} = 7.755 \cdot k$ $\quad$ **Use:** $Fdes_{br} := 8 \cdot k$ (for each drive wheel)

### B.6.2 Trolley Drive Braked Wheel Design Force

The trolley drive is separate for each drive wheel. For design purposes, the calculated trolley wheel resistance is doubled to account for the independent drive action, potential skewing and other uncertainties.

$nw_{tr} := 1$ $\quad Fdes_{tr} := \frac{2.0F_{tr}}{nw_{tr}} = 3.956 \cdot k$ $\quad$ **Use:** $Fdes_{tr} := 4 \cdot k$ (for each drive wheel)

**CAL-20776-SE-007**
**CRANE NON-LINEAR SEISMIC ANALYSES**
**ATTACHMENT C**
**EFFECTIVE ELASTIC STIFFNESS VALUES (KE)**
**NON-LINEAR ELASTIC STIFFNESS VALUES (K)**

## C.1 PURPOSE

The purpose of this calculation is to:

(1) Develop the Effective Elastic stiffness (KE) for the crane drive wheel non-linear rolling resistance Link/Support elements. The elastic stiffness values are used to develop the motion of the trolley and bridge when rolling during the design basis earthquake.
(2) Develop the non-linear stiffness values. The dynamic stiffness (K) is the elastic slope of the non-linear force displacement (hysteresis curve) relationship shown in Figure 4.1 [C1]. The stiffness is calculated sufficiently high so that relatively small (compared with rolling displacements) element displacements would occur before the yield limit is reached.

## C.2 UNITS

$k := 1000 \cdot lbf$ $\quad ksi = 1000\,psi$ $\quad ton := 2000 \cdot lbf$

## C.3 REFERENCES

[C1] CAL-20776-SE-007 (This calculation).
[C2] ET-CEM-08-0004, R0, "Seismic Amplified Response Spectra for the Analysis of Aux. Building Crane," Dominion Electric, Kewaunee, 3/24/08.

## C.4 DESIGN INPUTS

| | | |
|---|---|---|
| Trolley weight: | $W_t := 112 \cdot k$ | [C1; Section 4.3] |
| Bridge weight: | $W_b := 106 \cdot k$ | [C1; Section 4.3] |
| Braked trolley rolling resistance: | $R_t := 8 \cdot k$ | [C1; Attachment B] |
| Braked bridge rolling resistance: | $R_b := 16 \cdot k$ | [C1; Attachment B] |
| Peak spectral acceleration frequency - NS: | $f_{ns} := 1.5 \cdot Hz$ | [C2; Attachment 2] |
| Peak spectral acceleration frequency - EW: | $f_{ew} := 2.2 \cdot Hz$ | [C2; Attachment 2] |

## C.5 CALCULATIONS

### C.5.1 Effective Elastic Stiffness (KE)

Trolley mass: $M_t := \frac{W_t}{g} = 0.290 \cdot \frac{k \cdot sec^2}{in}$

Crane Mass: $M_c := \frac{W_t + W_b}{g} = 0.565 \cdot \frac{k \cdot sec^2}{in}$

Estimate the acceleration at which the trolley and crane would start to roll (use: F = M x A):

$$a_t := \frac{R_t}{M_t} = 0.071 \cdot g \qquad a_c := \frac{R_b}{M_c} = 0.073 \cdot g$$

Find the approximate corresponding frequencies for the trolley and crane accelerations on the design basis spectra.
The trolley rolling direction is in the North-South (model "X") direction. The crane bridge rolls in the East-West (model "Y") direction.

$fns_t := 0.4 \cdot Hz$ [C2; Attachment 2, NS un-broadened spectra]

$few_b := 0.5 \cdot Hz$ [C2; Attachment 2, EW un-broadened "other" spectra]

Calculate the stiffness associated with the above frequencies (use: F = (1 / 2π) SQRT(K / M):

$$kns_t := \left(2 \cdot \pi \cdot fns_t\right)^2 \cdot M_t = 1.832 \cdot \frac{k}{in}$$

$$kew_b := \left(2 \cdot \pi \cdot few_b\right)^2 \cdot M_c = 5.573 \cdot \frac{k}{in}$$

**C.5.2 Non-Linear Stiffness (K)**

The dynamic stiffness is chosen so that the representative trolley and bridge frequencies are sufficiently de-coupled from the peak spectral frequencies and that elastic displacements are small. Frequencies of 5 times the spectral peak frequencies are used to provide sufficient decoupling.

$$fd_{ns} := 5 \cdot f_{ns} = 7.5 \cdot Hz \qquad kd_{ns} := \left(2 \cdot \pi \cdot fd_{ns}\right)^2 \cdot M_t = 644 \cdot \frac{k}{in}$$

$$fd_{ew} := 5 \cdot f_{ew} = 11 \cdot Hz \qquad kd_{ew} := \left(2 \cdot \pi \cdot fd_{ew}\right)^2 \cdot M_c = 2697 \cdot \frac{k}{in}$$

**C.6 CONCLUSIONS**

The trolley and crane stiffness values are modeled as linear springs at the drive wheels. Since there are two drive wheels for trolley and the crane bridge, the effective spring stiffness for each wheel is one-half the total stiffness.

**C.6.1 Effective Elastic Stiffness (KE)**

$$ke_t := \frac{kns_t}{2} = 0.916 \cdot \frac{k}{in}$$ (Ke at each trolley drive wheel in the "X" or "NS" direction)

$$ke_b := \frac{kew_b}{2} = 2.786 \cdot \frac{k}{in}$$ (Ke at each bridge drive wheel in the "Y" or "EW" direction)

**Use in analysis model (round up):**

Trolley: $ke_t := 1 \cdot \frac{k}{in}$ (for SAP global X (NS); local d.o.f. U2)

Bridge: $ke_b := 3 \cdot \frac{k}{in}$ (for SAP global Y (EW); local d.o.f. U3)

**C.6.2 Non-Linear Stiffness (K)**

$$k_t := \frac{kd_{ns}}{2} = 322.1 \cdot \frac{k}{in}$$ (K at each trolley drive wheel in the "X" or "NS" direction)

$$k_b := \frac{kd_{ew}}{2} = 1348.6 \cdot \frac{k}{in}$$ (K at each bridge drive wheel in the "Y" or "EW" direction)

**Use in analysis model (round up):**

Trolley: $k_t := 500 \cdot \frac{k}{in}$ (SAP global X (NS); local d.o.f. "U2")

Bridge: $k_b := 1500 \cdot \frac{k}{in}$ (SAP global Y (EW); local d.o.f. "U3)"

# CAL-20776-SE-007

# NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT D
## FRAME ELEMENT MEMBER FORCES

### Tabularized Selected Output

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## D.0 Case Member Force Summary

### D.0.1 Girders

| Frame Component | Case No | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|
| Girders | C01 | MAX: | 79 | 163 | 11 | 540 | 2,418 | 61,446 |
| Girders | C02 | MAX: | 79 | 200 | 11 | 508 | 2,605 | 39,180 |
| Girders | C03 | MAX: | 80 | 120 | 10 | 454 | 2,561 | 17,279 |
| Girders | C04 | MAX: | 78 | 62 | 12 | 582 | 2,503 | 20,884 |
| Girders | C05 | MAX: | 79 | 79 | 11 | 480 | 2,562 | 15,718 |
| Girders | C06 | MAX: | 81 | 59 | 10 | 452 | 2,467 | 9,677 |
| Girders | C07 | MAX: | 78 | 191 | 12 | 581 | 2,555 | 72,675 |
| Girders | C08 | MAX: | 80 | 244 | 11 | 469 | 2,583 | 47,824 |
| Girders | C09 | MAX: | 80 | 138 | 10 | 436 | 2,458 | 19,959 |
| Girders | C10 | MAX: | 77 | 70 | 12 | 570 | 2,476 | 25,271 |
| Girders | C11 | MAX: | 80 | 92 | 11 | 471 | 2,549 | 19,498 |
| Girders | C12 | MAX: | 80 | 72 | 10 | 432 | 2,531 | 11,024 |
| Girders | C13 | MAX: | 78 | 71 | 12 | 557 | 2,535 | 25,987 |
| Girders | C14 | MAX: | 80 | 92 | 11 | 464 | 2,568 | 19,300 |
| Girders | C15 | MAX: | 81 | 71 | 9 | 440 | 2,446 | 11,020 |
| | | MAX: | 81 | 244 | 12 | 582 | 2,605 | 72,675 |

### D.0.2 End Ties

| Frame Component | Case No | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|
| End Ties | C01 | MAX: | 12 | 2 | 15 | 0 | 1,743 | 93 |
| End Ties | C02 | MAX: | 12 | 2 | 22 | 0 | 2,613 | 67 |
| End Ties | C03 | MAX: | 14 | 2 | 22 | 0 | 2,566 | 73 |
| End Ties | C04 | MAX: | 12 | 2 | 15 | 0 | 1,845 | 88 |
| End Ties | C05 | MAX: | 12 | 2 | 22 | 0 | 2,568 | 97 |
| End Ties | C06 | MAX: | 11 | 2 | 21 | 0 | 2,468 | 69 |
| End Ties | C07 | MAX: | 13 | 2 | 16 | 0 | 1,876 | 86 |
| End Ties | C08 | MAX: | 13 | 2 | 21 | 0 | 2,588 | 81 |
| End Ties | C09 | MAX: | 16 | 2 | 21 | 0 | 2,456 | 67 |
| End Ties | C10 | MAX: | 14 | 1 | 16 | 0 | 1,874 | 64 |
| End Ties | C11 | MAX: | 13 | 2 | 21 | 0 | 2,552 | 74 |
| End Ties | C12 | MAX: | 11 | 2 | 21 | 0 | 2,533 | 67 |
| End Ties | C13 | MAX: | 11 | 2 | 16 | 0 | 1,875 | 81 |
| End Ties | C14 | MAX: | 12 | 2 | 21 | 0 | 2,572 | 86 |
| End Ties | C15 | MAX: | 10 | 2 | 20 | 0 | 2,444 | 68 |
| | | MAX: | 16 | 2 | 22 | 0 | 2,613 | 97 |

## D.0.3 Trucks

| Frame Component | Case No | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|
| Trucks | C01 | MAX: | 22 | 90 | 52 | 883 | 1,879 | 3,215 |
| Trucks | C02 | MAX: | 23 | 109 | 52 | 878 | 1,869 | 3,891 |
| Trucks | C03 | MAX: | 20 | 121 | 51 | 863 | 1,835 | 4,255 |
| Trucks | C04 | MAX: | 22 | 42 | 50 | 845 | 1,795 | 1,461 |
| Trucks | C05 | MAX: | 22 | 52 | 55 | 925 | 1,985 | 1,779 |
| Trucks | C06 | MAX: | 19 | 55 | 52 | 883 | 1,884 | 1,945 |
| Trucks | C07 | MAX: | 25 | 103 | 50 | 845 | 1,792 | 3,688 |
| Trucks | C08 | MAX: | 24 | 133 | 54 | 904 | 1,943 | 4,753 |
| Trucks | C09 | MAX: | 20 | 139 | 52 | 875 | 1,872 | 4,928 |
| Trucks | C10 | MAX: | 26 | 46 | 50 | 843 | 1,793 | 1,608 |
| Trucks | C11 | MAX: | 23 | 57 | 54 | 907 | 1,948 | 1,956 |
| Trucks | C12 | MAX: | 20 | 62 | 53 | 894 | 1,903 | 2,182 |
| Trucks | C13 | MAX: | 22 | 47 | 51 | 858 | 1,823 | 1,612 |
| Trucks | C14 | MAX: | 22 | 57 | 55 | 905 | 1,970 | 2,028 |
| Trucks | C15 | MAX: | 18 | 63 | 53 | 890 | 1,892 | 2,181 |
| | | MAX: | 26 | 139 | 55 | 925 | 1,985 | 4,928 |

## D.1 Case-01

| Case-01: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C01 | Max | 79 | -68 | 10 | 485 | 2,418 | 478 |
| G01 | 146 | C01 | Max | 79 | -61 | 10 | 485 | 1,052 | 21,005 |
| G01 | 0 | C01 | Min | -79 | -146 | -10 | -482 | -2,403 | -487 |
| G01 | 146 | C01 | Min | -79 | -140 | -10 | -482 | -1,043 | 9,226 |
| G02 | 0 | C01 | Max | 69 | -63 | 11 | 485 | 1,052 | 21,005 |
| G02 | 138 | C01 | Max | 69 | -56 | 11 | 485 | 570 | 39,554 |
| G02 | 0 | C01 | Min | -69 | -138 | -11 | -482 | -1,043 | 9,226 |
| G02 | 138 | C01 | Min | -69 | -132 | -11 | -482 | -568 | 17,480 |
| G03 | 0 | C01 | Max | 59 | -58 | 11 | 485 | 570 | 39,554 |
| G03 | 174.5 | C01 | Max | 59 | -50 | 11 | 485 | 2,370 | 61,391 |
| G03 | 0 | C01 | Min | -59 | -130 | -11 | -482 | -568 | 17,480 |
| G03 | 174.5 | C01 | Min | -59 | -122 | -11 | -482 | -2,375 | 27,055 |
| G04 | 0 | C01 | Max | 50 | 13 | 2 | 161 | 2,370 | 61,446 |
| G04 | 36.5 | C01 | Max | 50 | 14 | 2 | 161 | 2,335 | 60,979 |
| G04 | 0 | C01 | Min | -50 | 4 | -2 | -159 | -2,375 | 27,000 |
| G04 | 36.5 | C01 | Min | -50 | 5 | -2 | -159 | -2,341 | 26,808 |
| G05 | 0 | C01 | Max | 45 | 16 | 3 | 161 | 2,335 | 60,979 |
| G05 | 109.5 | C01 | Max | 45 | 21 | 3 | 161 | 2,124 | 59,086 |
| G05 | 0 | C01 | Min | -45 | 4 | -3 | -159 | -2,341 | 26,808 |
| G05 | 109.5 | C01 | Min | -45 | 9 | -3 | -159 | -2,133 | 25,997 |
| G06 | 0 | C01 | Max | 39 | 143 | 11 | 537 | 2,124 | 59,086 |
| G06 | 101.5 | C01 | Max | 39 | 148 | 11 | 537 | 1,088 | 44,358 |
| G06 | 0 | C01 | Min | -39 | 60 | -11 | -540 | -2,133 | 25,997 |
| G06 | 101.5 | C01 | Min | -39 | 65 | -11 | -540 | -1,091 | 19,633 |
| G07 | 0 | C01 | Max | 31 | 149 | 11 | 537 | 1,088 | 44,358 |
| G07 | 138 | C01 | Max | 31 | 155 | 11 | 537 | 566 | 23,497 |
| G07 | 0 | C01 | Min | -31 | 63 | -11 | -540 | -1,091 | 19,633 |
| G07 | 138 | C01 | Min | -31 | 70 | -11 | -540 | -562 | 10,314 |
| G08 | 0 | C01 | Max | 23 | 157 | 9 | 537 | 566 | 23,497 |
| G08 | 146 | C01 | Max | 23 | 163 | 9 | 537 | 1,739 | 760 |
| G08 | 0 | C01 | Min | -23 | 68 | -9 | -540 | -562 | 10,314 |
| G08 | 146 | C01 | Min | -23 | 75 | -9 | -540 | -1,726 | -763 |
| G09 | 0 | C01 | Max | 66 | -65 | 10 | 483 | 2,411 | 575 |
| G09 | 146 | C01 | Max | 66 | -59 | 10 | 483 | 1,046 | 20,574 |
| G09 | 0 | C01 | Min | -66 | -144 | -10 | -486 | -2,418 | -566 |
| G09 | 146 | C01 | Min | -66 | -138 | -10 | -486 | -1,047 | 9,086 |
| G10 | 0 | C01 | Max | 59 | -61 | 11 | 483 | 1,046 | 20,574 |
| G10 | 138 | C01 | Max | 59 | -55 | 11 | 483 | 557 | 38,944 |
| G10 | 0 | C01 | Min | -59 | -136 | -11 | -486 | -1,047 | 9,086 |
| G10 | 138 | C01 | Min | -59 | -131 | -11 | -486 | -551 | 17,158 |
| G11 | 0 | C01 | Max | 50 | -57 | 11 | 483 | 557 | 38,944 |
| G11 | 174.5 | C01 | Max | 50 | -50 | 11 | 483 | 2,381 | 60,762 |
| G11 | 0 | C01 | Min | -50 | -129 | -11 | -486 | -551 | 17,158 |
| G11 | 174.5 | C01 | Min | -50 | -122 | -11 | -486 | -2,367 | 26,574 |
| G12 | 0 | C01 | Max | 41 | 14 | 2 | 147 | 2,381 | 60,798 |
| G12 | 36.5 | C01 | Max | 41 | 15 | 2 | 147 | 2,335 | 60,296 |
| G12 | 0 | C01 | Min | -41 | 5 | -2 | -148 | -2,367 | 26,538 |
| G12 | 36.5 | C01 | Min | -41 | 6 | -2 | -148 | -2,319 | 26,323 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C01 | Max | 37 | 16 | 3 | 147 | 2,335 | 60,296 |
| G13 | 109.5 | C01 | Max | 37 | 21 | 3 | 147 | 2,108 | 58,356 |
| G13 | 0 | C01 | Min | -37 | 5 | -3 | -148 | -2,319 | 26,323 |
| G13 | 109.5 | C01 | Min | -37 | 9 | -3 | -148 | -2,088 | 25,468 |
| G14 | 0 | C01 | Max | 32 | 143 | 11 | 535 | 2,108 | 58,356 |
| G14 | 101.5 | C01 | Max | 32 | 147 | 11 | 535 | 1,086 | 43,697 |
| G14 | 0 | C01 | Min | -32 | 59 | -10 | -531 | -2,088 | 25,468 |
| G14 | 101.5 | C01 | Min | -32 | 63 | -10 | -531 | -1,071 | 19,222 |
| G15 | 0 | C01 | Max | 26 | 148 | 11 | 535 | 1,086 | 43,697 |
| G15 | 138 | C01 | Max | 26 | 154 | 11 | 535 | 518 | 22,998 |
| G15 | 0 | C01 | Min | -26 | 62 | -11 | -531 | -1,071 | 19,222 |
| G15 | 138 | C01 | Min | -26 | 67 | -11 | -531 | -511 | 10,163 |
| G16 | 0 | C01 | Max | 20 | 155 | 9 | 535 | 518 | 22,998 |
| G16 | 146 | C01 | Max | 20 | 161 | 9 | 535 | 1,710 | 701 |
| G16 | 0 | C01 | Min | -20 | 66 | -9 | -531 | -511 | 10,163 |
| G16 | 146 | C01 | Min | -20 | 72 | -9 | -531 | -1,710 | -699 |
| | **Girders** | **C01** | **MAX:** | **79** | **163** | **11** | **540** | **2,418** | **61,446** |

**Case-01: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **End Ties** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| ET1 | 0 | C01 | Max | 8 | -1 | 8 | 0 | 1,019 | -18 |
| ET1 | 120 | C01 | Max | 8 | 1 | 8 | 0 | 68 | 62 |
| ET1 | 0 | C01 | Min | -8 | -2 | -9 | 0 | -1,042 | -87 |
| ET1 | 120 | C01 | Min | -8 | -1 | -9 | 0 | -70 | -9 |
| ET2 | 0 | C01 | Max | 8 | 1 | 9 | 0 | 68 | 62 |
| ET2 | 120 | C01 | Max | 8 | 2 | 9 | 0 | 1,075 | -15 |
| ET2 | 0 | C01 | Min | -8 | -1 | -9 | 0 | -70 | -9 |
| ET2 | 120 | C01 | Min | -8 | 1 | -9 | 0 | -1,056 | -90 |
| ET3 | 0 | C01 | Max | 12 | -1 | 15 | 0 | 1,743 | -15 |
| ET3 | 120 | C01 | Max | 12 | 1 | 15 | 0 | 97 | 65 |
| ET3 | 0 | C01 | Min | -12 | -2 | -15 | 0 | -1,730 | -89 |
| ET3 | 120 | C01 | Min | -12 | -1 | -15 | 0 | -91 | -12 |
| ET4 | 0 | C01 | Max | 10 | 1 | 14 | 0 | 97 | 65 |
| ET4 | 120 | C01 | Max | 10 | 2 | 14 | 0 | 1,715 | -12 |
| ET4 | 0 | C01 | Min | -10 | -1 | -14 | 0 | -91 | -12 |
| ET4 | 120 | C01 | Min | -10 | 1 | -14 | 0 | -1,715 | -93 |
| | **End Ties** | **C01** | **MAX:** | **12** | **2** | **15** | **0** | **1,743** | **93** |

**Case-01: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **Trucks** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| TK1 | 0 | C01 | Max | 16 | -33 | 41 | 700 | 0 | 275 |
| TK1 | 36 | C01 | Max | 16 | -31 | 41 | 700 | 1,473 | 2,673 |
| TK1 | 0 | C01 | Min | -16 | -78 | -41 | -701 | 0 | -274 |
| TK1 | 36 | C01 | Min | -16 | -76 | -41 | -701 | -1,475 | 1,241 |
| TK2 | 0 | C01 | Max | 1 | 80 | 52 | 880 | 1,879 | 2,916 |
| TK2 | 36 | C01 | Max | 1 | 82 | 52 | 880 | 0 | 0 |
| TK2 | 0 | C01 | Min | -1 | 30 | -52 | -883 | -1,873 | 1,103 |
| TK2 | 36 | C01 | Min | -1 | 32 | -52 | -883 | 0 | 0 |
| TK3 | 0 | C01 | Max | 1 | -35 | 43 | 714 | 0 | 0 |
| TK3 | 36 | C01 | Max | 1 | -33 | 43 | 714 | 1,518 | 2,720 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C01 | Min | -1 | -77 | -42 | -721 | 0 | 0 |
| TK3 | 36 | C01 | Min | -1 | -75 | -42 | -721 | -1,533 | 1,212 |
| TK4 | 0 | C01 | Max | 1 | 76 | 43 | 722 | 1,543 | 2,775 |
| TK4 | 36 | C01 | Max | 1 | 78 | 43 | 722 | 0 | 0 |
| TK4 | 0 | C01 | Min | -1 | 28 | -43 | -728 | -1,532 | 1,052 |
| TK4 | 36 | C01 | Min | -1 | 30 | -43 | -728 | 0 | 0 |
| TK5 | 0 | C01 | Max | 22 | -36 | 2 | 0 | 0 | 380 |
| TK5 | 36 | C01 | Max | 22 | -34 | 2 | 0 | 56 | 2,979 |
| TK5 | 0 | C01 | Min | -22 | -87 | -2 | 0 | 0 | -380 |
| TK5 | 36 | C01 | Min | -22 | -85 | -2 | 0 | -56 | 1,376 |
| TK6 | 0 | C01 | Max | 1 | 88 | 2 | 0 | 54 | 3,215 |
| TK6 | 36 | C01 | Max | 1 | 90 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C01 | Min | -1 | 34 | -2 | 0 | -54 | 1,244 |
| TK6 | 36 | C01 | Min | -1 | 36 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C01 | Max | 1 | -38 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C01 | Max | 1 | -36 | 2 | 0 | 58 | 3,018 |
| TK7 | 0 | C01 | Min | -1 | -85 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C01 | Min | -1 | -83 | -2 | 0 | -58 | 1,346 |
| TK8 | 0 | C01 | Max | 1 | 85 | 2 | 0 | 54 | 3,094 |
| TK8 | 36 | C01 | Max | 1 | 87 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C01 | Min | -1 | 31 | -2 | 0 | -54 | 1,166 |
| TK8 | 36 | C01 | Min | -1 | 33 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C01** | **MAX:** | **22** | **90** | **52** | **883** | **1,879** | **3,215** |

## D.2 Case-02

| Case-02: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C02 | Max | 79 | -48 | 7 | 153 | 2,599 | 513 |
| G01 | 146 | C02 | Max | 79 | -42 | 7 | 153 | 2,037 | 10,419 |
| G01 | 0 | C02 | Min | -79 | -75 | -7 | -151 | -2,593 | -518 |
| G01 | 146 | C02 | Min | -79 | -68 | -7 | -151 | -2,032 | 6,535 |
| G02 | 0 | C02 | Max | 70 | -43 | 7 | 153 | 2,037 | 10,419 |
| G02 | 138 | C02 | Max | 70 | -37 | 7 | 153 | 1,694 | 19,058 |
| G02 | 0 | C02 | Min | -70 | -66 | -7 | -151 | -2,032 | 6,535 |
| G02 | 138 | C02 | Min | -70 | -60 | -7 | -151 | -1,690 | 12,144 |
| G03 | 0 | C02 | Max | 61 | -38 | 7 | 153 | 1,694 | 19,058 |
| G03 | 174.5 | C02 | Max | 61 | -30 | 7 | 153 | 1,305 | 28,570 |
| G03 | 0 | C02 | Min | -61 | -59 | -7 | -151 | -1,690 | 12,144 |
| G03 | 174.5 | C02 | Min | -61 | -51 | -7 | -151 | -1,303 | 18,170 |
| G04 | 0 | C02 | Max | 54 | -31 | 7 | 153 | 1,305 | 28,570 |
| G04 | 36.5 | C02 | Max | 54 | -29 | 7 | 153 | 1,260 | 30,341 |
| G04 | 0 | C02 | Min | -54 | -50 | -7 | -151 | -1,303 | 18,170 |
| G04 | 36.5 | C02 | Min | -54 | -49 | -7 | -151 | -1,259 | 19,299 |
| G05 | 0 | C02 | Max | 48 | -30 | 9 | 153 | 1,260 | 30,341 |
| G05 | 138 | C02 | Max | 48 | -23 | 9 | 153 | 1,211 | 36,347 |
| G05 | 0 | C02 | Min | -48 | -48 | -9 | -151 | -1,259 | 19,299 |
| G05 | 138 | C02 | Min | -48 | -42 | -9 | -151 | -1,211 | 23,163 |
| G06 | 0 | C02 | Max | 41 | -24 | 9 | 153 | 1,211 | 36,347 |
| G06 | 73 | C02 | Max | 41 | -21 | 9 | 153 | 1,508 | 39,107 |
| G06 | 0 | C02 | Min | -41 | -41 | -9 | -151 | -1,211 | 23,163 |
| G06 | 73 | C02 | Min | -41 | -38 | -9 | -151 | -1,508 | 24,923 |
| G07 | 0 | C02 | Max | 33 | 80 | 10 | 341 | 1,508 | 39,038 |
| G07 | 146 | C02 | Max | 33 | 86 | 10 | 341 | 1,893 | 27,104 |
| G07 | 0 | C02 | Min | -33 | 47 | -9 | -323 | -1,508 | 24,993 |
| G07 | 146 | C02 | Min | -33 | 54 | -9 | -323 | -1,937 | 17,459 |
| G08 | 0 | C02 | Max | 27 | 193 | 11 | 483 | 1,893 | 27,104 |
| G08 | 138 | C02 | Max | 27 | 200 | 11 | 483 | 2,605 | 1,044 |
| G08 | 0 | C02 | Min | -27 | 123 | -11 | -508 | -1,937 | 17,459 |
| G08 | 138 | C02 | Min | -27 | 130 | -11 | -508 | -2,585 | -1,046 |
| G09 | 0 | C02 | Max | 69 | -46 | 7 | 165 | 2,584 | 540 |
| G09 | 146 | C02 | Max | 69 | -41 | 7 | 165 | 2,015 | 10,135 |
| G09 | 0 | C02 | Min | -69 | -73 | -7 | -166 | -2,588 | -536 |
| G09 | 146 | C02 | Min | -69 | -67 | -7 | -166 | -2,017 | 6,377 |
| G10 | 0 | C02 | Max | 62 | -42 | 7 | 165 | 2,015 | 10,135 |
| G10 | 138 | C02 | Max | 62 | -36 | 7 | 165 | 1,640 | 18,710 |
| G10 | 0 | C02 | Min | -62 | -65 | -7 | -166 | -2,017 | 6,377 |
| G10 | 138 | C02 | Min | -62 | -60 | -7 | -166 | -1,640 | 11,820 |
| G11 | 0 | C02 | Max | 53 | -37 | 7 | 165 | 1,640 | 18,710 |
| G11 | 174.5 | C02 | Max | 53 | -30 | 7 | 165 | 1,282 | 28,256 |
| G11 | 0 | C02 | Min | -53 | -59 | -7 | -166 | -1,640 | 11,820 |
| G11 | 174.5 | C02 | Min | -53 | -52 | -7 | -166 | -1,278 | 17,797 |
| G12 | 0 | C02 | Max | 47 | -31 | 7 | 165 | 1,282 | 28,256 |
| G12 | 36.5 | C02 | Max | 47 | -30 | 7 | 165 | 1,240 | 30,057 |
| G12 | 0 | C02 | Min | -47 | -51 | -7 | -166 | -1,278 | 17,797 |
| G12 | 36.5 | C02 | Min | -47 | -49 | -7 | -166 | -1,236 | 18,933 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C02 | Max | 43 | -30 | 9 | 165 | 1,240 | 30,057 |
| G13 | 138 | C02 | Max | 43 | -25 | 9 | 165 | 1,261 | 36,269 |
| G13 | 0 | C02 | Min | -43 | -49 | -9 | -166 | -1,236 | 18,933 |
| G13 | 138 | C02 | Min | -43 | -43 | -9 | -166 | -1,254 | 22,847 |
| G14 | 0 | C02 | Max | 37 | -25 | 9 | 165 | 1,261 | 36,269 |
| G14 | 73 | C02 | Max | 37 | -23 | 9 | 165 | 1,660 | 39,180 |
| G14 | 0 | C02 | Min | -37 | -42 | -9 | -166 | -1,254 | 22,847 |
| G14 | 73 | C02 | Min | -37 | -39 | -9 | -166 | -1,652 | 24,670 |
| G15 | 0 | C02 | Max | 30 | 81 | 10 | 425 | 1,660 | 39,010 |
| G15 | 146 | C02 | Max | 30 | 87 | 10 | 425 | 1,929 | 26,959 |
| G15 | 0 | C02 | Min | -31 | 51 | -10 | -443 | -1,652 | 24,841 |
| G15 | 146 | C02 | Min | -31 | 56 | -10 | -443 | -1,876 | 16,853 |
| G16 | 0 | C02 | Max | 25 | 192 | 11 | 498 | 1,929 | 26,959 |
| G16 | 138 | C02 | Max | 25 | 197 | 11 | 498 | 2,574 | 1,007 |
| G16 | 0 | C02 | Min | -25 | 120 | -11 | -473 | -1,876 | 16,853 |
| G16 | 138 | C02 | Min | -25 | 126 | -11 | -473 | -2,584 | -1,005 |
| | **Girders** | **C02** | **MAX:** | **79** | **200** | **11** | **508** | **2,605** | **39,180** |

| Case-02: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| End Ties | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | C02 | Max | 12 | -1 | 9 | 0 | 1,010 | -39 |
| ET1 | 120 | C02 | Max | 12 | 0 | 9 | 0 | 88 | 40 |
| ET1 | 0 | C02 | Min | -12 | -2 | -9 | 0 | -1,023 | -66 |
| ET1 | 120 | C02 | Min | -12 | 0 | -9 | 0 | -89 | 13 |
| ET2 | 0 | C02 | Max | 11 | 0 | 8 | 0 | 88 | 40 |
| ET2 | 120 | C02 | Max | 11 | 2 | 8 | 0 | 995 | -38 |
| ET2 | 0 | C02 | Min | -11 | 0 | -8 | 0 | -89 | 13 |
| ET2 | 120 | C02 | Min | -11 | 1 | -8 | 0 | -984 | -67 |
| ET3 | 0 | C02 | Max | 11 | -1 | 22 | 0 | 2,613 | -39 |
| ET3 | 120 | C02 | Max | 11 | 0 | 22 | 0 | 89 | 41 |
| ET3 | 0 | C02 | Min | -10 | -2 | -22 | 0 | -2,593 | -66 |
| ET3 | 120 | C02 | Min | -10 | 0 | -22 | 0 | -73 | 12 |
| ET4 | 0 | C02 | Max | 10 | 0 | 22 | 0 | 89 | 41 |
| ET4 | 120 | C02 | Max | 10 | 2 | 22 | 0 | 2,592 | -37 |
| ET4 | 0 | C02 | Min | -9 | 0 | -21 | 0 | -73 | 12 |
| ET4 | 120 | C02 | Min | -9 | 1 | -21 | 0 | -2,582 | -67 |
| | **End Ties** | **C02** | **MAX:** | **12** | **2** | **22** | **0** | **2,613** | **67** |

| Case-02: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | C02 | Max | 23 | -17 | 52 | 877 | 0 | 399 |
| TK1 | 36 | C02 | Max | 23 | -15 | 52 | 877 | 1,867 | 1,432 |
| TK1 | 0 | C02 | Min | -23 | -48 | -52 | -878 | 0 | -399 |
| TK1 | 36 | C02 | Min | -23 | -46 | -52 | -878 | -1,869 | 844 |
| TK2 | 0 | C02 | Max | 1 | 45 | 47 | 795 | 1,690 | 1,672 |
| TK2 | 36 | C02 | Max | 1 | 47 | 47 | 795 | 0 | 0 |
| TK2 | 0 | C02 | Min | -1 | 19 | -47 | -797 | -1,685 | 709 |
| TK2 | 36 | C02 | Min | -1 | 21 | -47 | -797 | 0 | 0 |
| TK3 | 0 | C02 | Max | 1 | -22 | 42 | 714 | 0 | 0 |
| TK3 | 36 | C02 | Max | 1 | -20 | 42 | 714 | 1,511 | 1,562 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C02 | Min | -1 | -44 | -42 | -719 | 0 | 0 |
| TK3 | 36 | C02 | Min | -1 | -42 | -42 | -719 | -1,520 | 749 |
| TK4 | 0 | C02 | Max | 1 | 40 | 51 | 865 | 1,841 | 1,483 |
| TK4 | 36 | C02 | Max | 1 | 42 | 51 | 865 | 0 | 0 |
| TK4 | 0 | C02 | Min | -1 | 19 | -51 | -868 | -1,834 | 724 |
| TK4 | 36 | C02 | Min | -1 | 21 | -51 | -868 | 0 | 0 |
| TK5 | 0 | C02 | Max | 20 | -61 | 2 | 1 | 0 | 347 |
| TK5 | 36 | C02 | Max | 20 | -59 | 2 | 1 | 62 | 3,677 |
| TK5 | 0 | C02 | Min | -20 | -107 | -2 | -1 | 0 | -347 |
| TK5 | 36 | C02 | Min | -20 | -105 | -2 | -1 | -62 | 2,316 |
| TK6 | 0 | C02 | Max | 1 | 107 | 2 | 0 | 61 | 3,891 |
| TK6 | 36 | C02 | Max | 1 | 109 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C02 | Min | -1 | 60 | -2 | 0 | -61 | 2,203 |
| TK6 | 36 | C02 | Min | -1 | 62 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C02 | Max | 1 | -66 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C02 | Max | 1 | -64 | 2 | 0 | 57 | 3,652 |
| TK7 | 0 | C02 | Min | -1 | -102 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C02 | Min | -1 | -100 | -2 | 0 | -57 | 2,331 |
| TK8 | 0 | C02 | Max | 1 | 101 | 2 | 0 | 59 | 3,659 |
| TK8 | 36 | C02 | Max | 1 | 103 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C02 | Min | -1 | 61 | -2 | 0 | -59 | 2,224 |
| TK8 | 36 | C02 | Min | -1 | 63 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C02** | **MAX:** | **23** | **109** | **52** | **878** | **1,869** | **3,891** |

## D.3 Case-03

| Case-03: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C03 | Max | 80 | -29 | 7 | 77 | 2,366 | 470 |
| G01 | 146 | C03 | Max | 80 | -23 | 7 | 77 | 1,822 | 5,831 |
| G01 | 0 | C03 | Min | -80 | -43 | -7 | -73 | -2,362 | -475 |
| G01 | 146 | C03 | Min | -80 | -36 | -7 | -73 | -1,819 | 3,763 |
| G02 | 0 | C03 | Max | 71 | -24 | 7 | 77 | 1,822 | 5,831 |
| G02 | 138 | C03 | Max | 71 | -18 | 7 | 77 | 1,608 | 10,148 |
| G02 | 0 | C03 | Min | -71 | -35 | -7 | -73 | -1,819 | 3,763 |
| G02 | 138 | C03 | Min | -71 | -29 | -7 | -73 | -1,607 | 6,737 |
| G03 | 0 | C03 | Max | 61 | -19 | 6 | 77 | 1,608 | 10,148 |
| G03 | 174.5 | C03 | Max | 61 | -11 | 6 | 77 | 1,243 | 14,137 |
| G03 | 0 | C03 | Min | -61 | -28 | -6 | -73 | -1,607 | 6,737 |
| G03 | 174.5 | C03 | Min | -61 | -20 | -6 | -73 | -1,243 | 9,488 |
| G04 | 0 | C03 | Max | 54 | -12 | 6 | 77 | 1,243 | 14,137 |
| G04 | 36.5 | C03 | Max | 54 | -10 | 6 | 77 | 1,144 | 14,757 |
| G04 | 0 | C03 | Min | -54 | -19 | -6 | -73 | -1,243 | 9,488 |
| G04 | 36.5 | C03 | Min | -54 | -17 | -6 | -73 | -1,145 | 9,928 |
| G05 | 0 | C03 | Max | 49 | -10 | 7 | 77 | 1,144 | 14,757 |
| G05 | 129.5 | C03 | Max | 49 | -4 | 7 | 77 | 878 | 16,352 |
| G05 | 0 | C03 | Min | -49 | -17 | -7 | -73 | -1,145 | 9,928 |
| G05 | 129.5 | C03 | Min | -49 | -11 | -7 | -73 | -881 | 11,116 |
| G06 | 0 | C03 | Max | 43 | -5 | 8 | 77 | 878 | 16,352 |
| G06 | 81.5 | C03 | Max | 43 | -1 | 8 | 77 | 1,118 | 16,901 |
| G06 | 0 | C03 | Min | -42 | -11 | -8 | -73 | -881 | 11,116 |
| G06 | 81.5 | C03 | Min | -42 | -7 | -8 | -73 | -1,121 | 11,537 |
| G07 | 0 | C03 | Max | 36 | -1 | 10 | 77 | 1,118 | 16,901 |
| G07 | 138 | C03 | Max | 36 | 6 | 10 | 77 | 1,882 | 17,070 |
| G07 | 0 | C03 | Min | -36 | -8 | -10 | -73 | -1,121 | 11,537 |
| G07 | 138 | C03 | Min | -36 | -1 | -10 | -73 | -1,887 | 11,634 |
| G08 | 0 | C03 | Max | 27 | 114 | 9 | 409 | 1,882 | 16,876 |
| G08 | 146 | C03 | Max | 27 | 120 | 9 | 409 | 2,561 | 1,064 |
| G08 | 0 | C03 | Min | -27 | 76 | -9 | -411 | -1,887 | 11,827 |
| G08 | 146 | C03 | Min | -27 | 83 | -9 | -411 | -2,553 | -1,066 |
| G09 | 0 | C03 | Max | 71 | -28 | 6 | 74 | 2,364 | 485 |
| G09 | 146 | C03 | Max | 71 | -22 | 6 | 74 | 1,801 | 5,530 |
| G09 | 0 | C03 | Min | -71 | -40 | -6 | -77 | -2,371 | -480 |
| G09 | 146 | C03 | Min | -71 | -34 | -6 | -77 | -1,805 | 3,607 |
| G10 | 0 | C03 | Max | 64 | -23 | 6 | 74 | 1,801 | 5,530 |
| G10 | 138 | C03 | Max | 64 | -17 | 6 | 74 | 1,544 | 9,664 |
| G10 | 0 | C03 | Min | -64 | -34 | -6 | -77 | -1,805 | 3,607 |
| G10 | 138 | C03 | Min | -64 | -28 | -6 | -77 | -1,545 | 6,522 |
| G11 | 0 | C03 | Max | 56 | -18 | 6 | 74 | 1,544 | 9,664 |
| G11 | 174.5 | C03 | Max | 56 | -11 | 6 | 74 | 1,076 | 13,668 |
| G11 | 0 | C03 | Min | -56 | -27 | -6 | -77 | -1,545 | 6,522 |
| G11 | 174.5 | C03 | Min | -56 | -20 | -6 | -77 | -1,072 | 9,228 |
| G12 | 0 | C03 | Max | 49 | -12 | 6 | 74 | 1,076 | 13,668 |
| G12 | 36.5 | C03 | Max | 49 | -11 | 6 | 74 | 1,005 | 14,318 |
| G12 | 0 | C03 | Min | -50 | -19 | -6 | -77 | -1,072 | 9,228 |
| G12 | 36.5 | C03 | Min | -50 | -18 | -6 | -77 | -1,001 | 9,671 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C03 | Max | 45 | -12 | 7 | 74 | 1,005 | 14,318 |
| G13 | 129.5 | C03 | Max | 45 | -6 | 7 | 74 | 864 | 16,092 |
| G13 | 0 | C03 | Min | -45 | -17 | -7 | -77 | -1,001 | 9,671 |
| G13 | 129.5 | C03 | Min | -45 | -12 | -7 | -77 | -856 | 10,903 |
| G14 | 0 | C03 | Max | 39 | -6 | 7 | 74 | 864 | 16,092 |
| G14 | 81.5 | C03 | Max | 39 | -3 | 7 | 74 | 1,106 | 16,793 |
| G14 | 0 | C03 | Min | -39 | -12 | -7 | -77 | -856 | 10,903 |
| G14 | 81.5 | C03 | Min | -39 | -9 | -7 | -77 | -1,096 | 11,400 |
| G15 | 0 | C03 | Max | 33 | -1 | 8 | 74 | 1,106 | 16,793 |
| G15 | 138 | C03 | Max | 33 | 5 | 8 | 74 | 1,864 | 17,279 |
| G15 | 0 | C03 | Min | -33 | -10 | -9 | -77 | -1,096 | 11,400 |
| G15 | 138 | C03 | Min | -33 | -5 | -9 | -77 | -1,851 | 11,718 |
| G16 | 0 | C03 | Max | 25 | 114 | 9 | 454 | 1,864 | 17,166 |
| G16 | 146 | C03 | Max | 25 | 120 | 9 | 454 | 2,518 | 974 |
| G16 | 0 | C03 | Min | -25 | 79 | -9 | -451 | -1,851 | 11,830 |
| G16 | 146 | C03 | Min | -25 | 85 | -9 | -451 | -2,517 | -972 |
| | **Girders** | **C03** | **MAX:** | **80** | **120** | **10** | **454** | **2,561** | **17,279** |

**Case-03: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **End Ties** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| ET1 | 0 | C03 | Max | 11 | -1 | 7 | 0 | 880 | -36 |
| ET1 | 120 | C03 | Max | 11 | 0 | 7 | 0 | 100 | 43 |
| ET1 | 0 | C03 | Min | -11 | -2 | -8 | 0 | -892 | -69 |
| ET1 | 120 | C03 | Min | -11 | 0 | -8 | 0 | -101 | 10 |
| ET2 | 0 | C03 | Max | 10 | 0 | 7 | 0 | 100 | 43 |
| ET2 | 120 | C03 | Max | 10 | 2 | 7 | 0 | 888 | -36 |
| ET2 | 0 | C03 | Min | -10 | 0 | -7 | 0 | -101 | 10 |
| ET2 | 120 | C03 | Min | -10 | 1 | -7 | 0 | -878 | -69 |
| ET3 | 0 | C03 | Max | 14 | -1 | 22 | 0 | 2,566 | -32 |
| ET3 | 120 | C03 | Max | 14 | 0 | 22 | 0 | 82 | 45 |
| ET3 | 0 | C03 | Min | 6 | -2 | -22 | 0 | -2,558 | -73 |
| ET3 | 120 | C03 | Min | 6 | 0 | -22 | 0 | -78 | 7 |
| ET4 | 0 | C03 | Max | 14 | 0 | 21 | 0 | 82 | 45 |
| ET4 | 120 | C03 | Max | 14 | 2 | 21 | 0 | 2,519 | -35 |
| ET4 | 0 | C03 | Min | 7 | 0 | -21 | 0 | -78 | 7 |
| ET4 | 120 | C03 | Min | 7 | 1 | -21 | 0 | -2,521 | -71 |
| | **End Ties** | **C03** | **MAX:** | **14** | **2** | **22** | **0** | **2,566** | **73** |

**Case-03: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **Trucks** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| TK1 | 0 | C03 | Max | 20 | -11 | 51 | 861 | 0 | 340 |
| TK1 | 36 | C03 | Max | 20 | -9 | 51 | 861 | 1,832 | 859 |
| TK1 | 0 | C03 | Min | -20 | -29 | -51 | -863 | 0 | -340 |
| TK1 | 36 | C03 | Min | -20 | -27 | -51 | -863 | -1,835 | 511 |
| TK2 | 0 | C03 | Max | 1 | 31 | 46 | 773 | 1,647 | 1,152 |
| TK2 | 36 | C03 | Max | 1 | 33 | 46 | 773 | 0 | 0 |
| TK2 | 0 | C03 | Min | -1 | 8 | -46 | -776 | -1,642 | 320 |
| TK2 | 36 | C03 | Min | -1 | 10 | -46 | -776 | 0 | 0 |
| TK3 | 0 | C03 | Max | 1 | -12 | 41 | 695 | 0 | 0 |
| TK3 | 36 | C03 | Max | 1 | -10 | 41 | 695 | 1,463 | 993 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C03 | Min | -1 | -29 | -41 | -699 | 0 | 0 |
| TK3 | 36 | C03 | Min | -1 | -27 | -41 | -699 | -1,472 | 408 |
| TK4 | 0 | C03 | Max | 1 | 23 | 47 | 793 | 1,703 | 879 |
| TK4 | 36 | C03 | Max | 1 | 25 | 47 | 793 | 0 | 0 |
| TK4 | 0 | C03 | Min | -1 | 11 | -47 | -796 | -1,696 | 419 |
| TK4 | 36 | C03 | Min | -1 | 13 | -47 | -796 | 0 | 0 |
| TK5 | 0 | C03 | Max | 17 | -75 | 2 | 1 | 0 | 295 |
| TK5 | 36 | C03 | Max | 17 | -73 | 2 | 1 | 61 | 4,153 |
| TK5 | 0 | C03 | Min | -17 | -121 | -2 | -1 | 0 | -295 |
| TK5 | 36 | C03 | Min | -17 | -119 | -2 | -1 | -61 | 2,838 |
| TK6 | 0 | C03 | Max | 1 | 117 | 2 | 0 | 59 | 4,255 |
| TK6 | 36 | C03 | Max | 1 | 119 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C03 | Min | -1 | 73 | -2 | 0 | -59 | 2,656 |
| TK6 | 36 | C03 | Min | -1 | 75 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C03 | Max | 1 | -79 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C03 | Max | 1 | -77 | 2 | 0 | 62 | 4,007 |
| TK7 | 0 | C03 | Min | -1 | -112 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C03 | Min | -1 | -110 | -2 | 0 | -62 | 2,794 |
| TK8 | 0 | C03 | Max | 1 | 114 | 2 | 0 | 59 | 4,128 |
| TK8 | 36 | C03 | Max | 1 | 116 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C03 | Min | -1 | 76 | -2 | 0 | -59 | 2,755 |
| TK8 | 36 | C03 | Min | -1 | 78 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C03** | **MAX:** | **20** | **121** | **51** | **863** | **1,835** | **4,255** |

## D.4 Case-04

| Case-04: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C04 | Max | 78 | -39 | 10 | 515 | 2,503 | 485 |
| G01 | 146 | C04 | Max | 78 | -33 | 10 | 515 | 1,094 | 8,043 |
| G01 | 0 | C04 | Min | -78 | -58 | -10 | -514 | -2,495 | -493 |
| G01 | 146 | C04 | Min | -78 | -52 | -10 | -514 | -1,088 | 5,285 |
| G02 | 0 | C04 | Max | 69 | -35 | 12 | 515 | 1,094 | 8,043 |
| G02 | 138 | C04 | Max | 69 | -29 | 12 | 515 | 610 | 14,333 |
| G02 | 0 | C04 | Min | -69 | -50 | -12 | -514 | -1,088 | 5,285 |
| G02 | 138 | C04 | Min | -69 | -44 | -12 | -514 | -607 | 9,819 |
| G03 | 0 | C04 | Max | 59 | -29 | 12 | 515 | 610 | 14,333 |
| G03 | 174.5 | C04 | Max | 59 | -21 | 12 | 515 | 2,494 | 20,884 |
| G03 | 0 | C04 | Min | -59 | -43 | -12 | -514 | -607 | 9,819 |
| G03 | 174.5 | C04 | Min | -59 | -35 | -12 | -514 | -2,494 | 14,476 |
| G04 | 0 | C04 | Max | 48 | 8 | 2 | 149 | 2,494 | 20,818 |
| G04 | 36.5 | C04 | Max | 48 | 10 | 2 | 149 | 2,455 | 20,622 |
| G04 | 0 | C04 | Min | -48 | -1 | -2 | -151 | -2,494 | 14,541 |
| G04 | 36.5 | C04 | Min | -48 | 1 | -2 | -151 | -2,454 | 14,415 |
| G05 | 0 | C04 | Max | 44 | 10 | 3 | 149 | 2,455 | 20,622 |
| G05 | 109.5 | C04 | Max | 44 | 15 | 3 | 149 | 2,234 | 19,703 |
| G05 | 0 | C04 | Min | -44 | 1 | -3 | -151 | -2,454 | 14,415 |
| G05 | 109.5 | C04 | Min | -44 | 6 | -3 | -151 | -2,231 | 13,639 |
| G06 | 0 | C04 | Max | 38 | 42 | 11 | 577 | 2,234 | 19,703 |
| G06 | 101.5 | C04 | Max | 38 | 47 | 11 | 577 | 1,142 | 15,409 |
| G06 | 0 | C04 | Min | -38 | 27 | -11 | -577 | -2,231 | 13,639 |
| G06 | 101.5 | C04 | Min | -38 | 32 | -11 | -577 | -1,138 | 10,464 |
| G07 | 0 | C04 | Max | 31 | 47 | 11 | 577 | 1,142 | 15,409 |
| G07 | 138 | C04 | Max | 31 | 53 | 11 | 577 | 561 | 8,660 |
| G07 | 0 | C04 | Min | -31 | 31 | -11 | -577 | -1,138 | 10,464 |
| G07 | 138 | C04 | Min | -31 | 37 | -11 | -577 | -555 | 5,556 |
| G08 | 0 | C04 | Max | 23 | 55 | 10 | 577 | 561 | 8,660 |
| G08 | 146 | C04 | Max | 23 | 62 | 10 | 577 | 1,841 | 769 |
| G08 | 0 | C04 | Min | -23 | 35 | -10 | -577 | -555 | 5,556 |
| G08 | 146 | C04 | Min | -23 | 42 | -10 | -577 | -1,833 | -771 |
| G09 | 0 | C04 | Max | 68 | -38 | 10 | 522 | 2,485 | 555 |
| G09 | 146 | C04 | Max | 68 | -32 | 10 | 522 | 1,081 | 7,580 |
| G09 | 0 | C04 | Min | -68 | -55 | -10 | -523 | -2,486 | -547 |
| G09 | 146 | C04 | Min | -68 | -50 | -10 | -523 | -1,079 | 5,175 |
| G10 | 0 | C04 | Max | 59 | -32 | 12 | 522 | 1,081 | 7,580 |
| G10 | 138 | C04 | Max | 59 | -27 | 12 | 522 | 592 | 13,852 |
| G10 | 0 | C04 | Min | -59 | -49 | -12 | -523 | -1,079 | 5,175 |
| G10 | 138 | C04 | Min | -59 | -43 | -12 | -523 | -586 | 9,368 |
| G11 | 0 | C04 | Max | 51 | -28 | 12 | 522 | 592 | 13,852 |
| G11 | 174.5 | C04 | Max | 51 | -21 | 12 | 522 | 2,500 | 20,522 |
| G11 | 0 | C04 | Min | -51 | -42 | -12 | -523 | -586 | 9,368 |
| G11 | 174.5 | C04 | Min | -51 | -35 | -12 | -523 | -2,490 | 13,727 |
| G12 | 0 | C04 | Max | 42 | 8 | 2 | 142 | 2,500 | 20,321 |
| G12 | 36.5 | C04 | Max | 42 | 9 | 2 | 142 | 2,454 | 20,101 |
| G12 | 0 | C04 | Min | -42 | 1 | -2 | -141 | -2,490 | 13,929 |
| G12 | 36.5 | C04 | Min | -42 | 2 | -2 | -141 | -2,444 | 13,768 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C04 | Max | 38 | 10 | 3 | 142 | 2,454 | 20,101 |
| G13 | 109.5 | C04 | Max | 38 | 14 | 3 | 142 | 2,231 | 19,098 |
| G13 | 0 | C04 | Min | -38 | 2 | -3 | -141 | -2,444 | 13,768 |
| G13 | 109.5 | C04 | Min | -38 | 7 | -3 | -141 | -2,224 | 12,985 |
| G14 | 0 | C04 | Max | 32 | 42 | 11 | 582 | 2,231 | 19,098 |
| G14 | 101.5 | C04 | Max | 32 | 46 | 11 | 582 | 1,132 | 14,767 |
| G14 | 0 | C04 | Min | -32 | 26 | -11 | -582 | -2,224 | 12,985 |
| G14 | 101.5 | C04 | Min | -32 | 30 | -11 | -582 | -1,125 | 10,034 |
| G15 | 0 | C04 | Max | 26 | 47 | 11 | 582 | 1,132 | 14,767 |
| G15 | 138 | C04 | Max | 26 | 52 | 11 | 582 | 513 | 8,140 |
| G15 | 0 | C04 | Min | -26 | 29 | -11 | -582 | -1,125 | 10,034 |
| G15 | 138 | C04 | Min | -26 | 35 | -11 | -582 | -508 | 5,425 |
| G16 | 0 | C04 | Max | 20 | 53 | 10 | 582 | 513 | 8,140 |
| G16 | 146 | C04 | Max | 20 | 58 | 10 | 582 | 1,836 | 726 |
| G16 | 0 | C04 | Min | -20 | 34 | -10 | -582 | -508 | 5,425 |
| G16 | 146 | C04 | Min | -20 | 40 | -10 | -582 | -1,831 | -723 |
| | **Girders** | **C04** | **MAX:** | **78** | **62** | **12** | **582** | **2,503** | **20,884** |

**Case-04: Element Forces - Frames**

| Frame End Ties | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| ET1 | 0 | C04 | Max | 9 | -1 | 9 | 0 | 1,074 | -16 |
| ET1 | 120 | C04 | Max | 9 | 1 | 9 | 0 | 70 | 62 |
| ET1 | 0 | C04 | Min | -9 | -2 | -9 | 0 | -1,096 | -88 |
| ET1 | 120 | C04 | Min | -9 | -1 | -9 | 0 | -71 | -9 |
| ET2 | 0 | C04 | Max | 8 | 1 | 9 | 0 | 70 | 62 |
| ET2 | 120 | C04 | Max | 8 | 2 | 9 | 0 | 1,092 | -17 |
| ET2 | 0 | C04 | Min | -8 | -1 | -9 | 0 | -71 | -9 |
| ET2 | 120 | C04 | Min | -8 | 1 | -9 | 0 | -1,072 | -88 |
| ET3 | 0 | C04 | Max | 12 | -1 | 15 | 0 | 1,845 | -17 |
| ET3 | 120 | C04 | Max | 12 | 1 | 15 | 0 | 106 | 61 |
| ET3 | 0 | C04 | Min | -12 | -2 | -15 | 0 | -1,838 | -87 |
| ET3 | 120 | C04 | Min | -12 | -1 | -15 | 0 | -105 | -8 |
| ET4 | 0 | C04 | Max | 11 | 1 | 15 | 0 | 106 | 61 |
| ET4 | 120 | C04 | Max | 11 | 2 | 15 | 0 | 1,835 | -18 |
| ET4 | 0 | C04 | Min | -11 | -1 | -15 | 0 | -105 | -8 |
| ET4 | 120 | C04 | Min | -11 | 1 | -15 | 0 | -1,839 | -87 |
| | **End Ties** | **C04** | **MAX:** | **12** | **2** | **15** | **0** | **1,845** | **88** |

**Case-04: Element Forces - Frames**

| Frame Trucks | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| TK1 | 0 | C04 | Max | 16 | -13 | 43 | 737 | 0 | 283 |
| TK1 | 36 | C04 | Max | 16 | -11 | 43 | 737 | 1,557 | 1,226 |
| TK1 | 0 | C04 | Min | -16 | -40 | -43 | -739 | 0 | -283 |
| TK1 | 36 | C04 | Min | -16 | -38 | -43 | -739 | -1,562 | 604 |
| TK2 | 0 | C04 | Max | 1 | 38 | 50 | 841 | 1,795 | 1,387 |
| TK2 | 36 | C04 | Max | 1 | 40 | 50 | 841 | 0 | 0 |
| TK2 | 0 | C04 | Min | -1 | 14 | -50 | -845 | -1,786 | 547 |
| TK2 | 36 | C04 | Min | -1 | 16 | -50 | -845 | 0 | 0 |
| TK3 | 0 | C04 | Max | 1 | -19 | 44 | 746 | 0 | 0 |
| TK3 | 36 | C04 | Max | 1 | -17 | 44 | 746 | 1,576 | 1,197 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C04 | Min | -1 | -34 | -44 | -752 | 0 | 0 |
| TK3 | 36 | C04 | Min | -1 | -32 | -44 | -752 | -1,589 | 652 |
| TK4 | 0 | C04 | Max | 1 | 33 | 43 | 729 | 1,542 | 1,223 |
| TK4 | 36 | C04 | Max | 1 | 35 | 43 | 729 | 0 | 0 |
| TK4 | 0 | C04 | Min | -1 | 13 | -43 | -733 | -1,534 | 521 |
| TK4 | 36 | C04 | Min | -1 | 15 | -43 | -733 | 0 | 0 |
| TK5 | 0 | C04 | Max | 22 | -14 | 2 | 1 | 0 | 387 |
| TK5 | 36 | C04 | Max | 22 | -12 | 2 | 1 | 58 | 1,312 |
| TK5 | 0 | C04 | Min | -22 | -42 | -2 | -1 | 0 | -387 |
| TK5 | 36 | C04 | Min | -22 | -40 | -2 | -1 | -58 | 626 |
| TK6 | 0 | C04 | Max | 1 | 40 | 2 | 0 | 57 | 1,461 |
| TK6 | 36 | C04 | Max | 1 | 42 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C04 | Min | -1 | 15 | -2 | 0 | -57 | 582 |
| TK6 | 36 | C04 | Min | -1 | 17 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C04 | Max | 1 | -20 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C04 | Max | 1 | -18 | 2 | 0 | 62 | 1,266 |
| TK7 | 0 | C04 | Min | -1 | -36 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C04 | Min | -1 | -34 | -2 | 0 | -62 | 682 |
| TK8 | 0 | C04 | Max | 1 | 35 | 2 | 0 | 57 | 1,307 |
| TK8 | 36 | C04 | Max | 1 | 37 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C04 | Min | -1 | 14 | -2 | 0 | -57 | 537 |
| TK8 | 36 | C04 | Min | -1 | 16 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C04** | **MAX:** | **22** | **42** | **50** | **845** | **1,795** | **1,461** |

## D.5 Case-05

| Case-05: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C05 | Max | 79 | -27 | 7 | 139 | 2,484 | 535 |
| G01 | 146 | C05 | Max | 79 | -20 | 7 | 139 | 1,970 | 5,828 |
| G01 | 0 | C05 | Min | -79 | -43 | -7 | -138 | -2,480 | -540 |
| G01 | 146 | C05 | Min | -79 | -36 | -7 | -138 | -1,967 | 3,347 |
| G02 | 0 | C05 | Max | 70 | -23 | 7 | 139 | 1,970 | 5,828 |
| G02 | 138 | C05 | Max | 70 | -17 | 7 | 139 | 1,698 | 9,806 |
| G02 | 0 | C05 | Min | -70 | -33 | -7 | -138 | -1,967 | 3,347 |
| G02 | 138 | C05 | Min | -70 | -27 | -7 | -138 | -1,696 | 6,264 |
| G03 | 0 | C05 | Max | 61 | -18 | 7 | 139 | 1,698 | 9,806 |
| G03 | 174.5 | C05 | Max | 61 | -10 | 7 | 139 | 1,261 | 13,327 |
| G03 | 0 | C05 | Min | -61 | -26 | -7 | -138 | -1,696 | 6,264 |
| G03 | 174.5 | C05 | Min | -61 | -18 | -7 | -138 | -1,259 | 8,982 |
| G04 | 0 | C05 | Max | 54 | -10 | 7 | 139 | 1,261 | 13,327 |
| G04 | 36.5 | C05 | Max | 54 | -8 | 7 | 139 | 1,225 | 13,850 |
| G04 | 0 | C05 | Min | -54 | -18 | -7 | -138 | -1,259 | 8,982 |
| G04 | 36.5 | C05 | Min | -54 | -17 | -7 | -138 | -1,223 | 9,415 |
| G05 | 0 | C05 | Max | 49 | -8 | 9 | 139 | 1,225 | 13,850 |
| G05 | 138 | C05 | Max | 49 | -1 | 9 | 139 | 1,266 | 15,226 |
| G05 | 0 | C05 | Min | -49 | -17 | -9 | -138 | -1,223 | 9,415 |
| G05 | 138 | C05 | Min | -49 | -10 | -9 | -138 | -1,266 | 10,555 |
| G06 | 0 | C05 | Max | 43 | -1 | 9 | 139 | 1,266 | 15,226 |
| G06 | 73 | C05 | Max | 43 | 2 | 9 | 139 | 1,532 | 15,662 |
| G06 | 0 | C05 | Min | -43 | -11 | -9 | -138 | -1,266 | 10,555 |
| G06 | 73 | C05 | Min | -43 | -7 | -9 | -138 | -1,532 | 10,751 |
| G07 | 0 | C05 | Max | 35 | 36 | 9 | 340 | 1,532 | 15,524 |
| G07 | 146 | C05 | Max | 35 | 43 | 9 | 340 | 1,942 | 10,589 |
| G07 | 0 | C05 | Min | -35 | 19 | -9 | -336 | -1,532 | 10,889 |
| G07 | 146 | C05 | Min | -35 | 25 | -9 | -336 | -1,949 | 6,827 |
| G08 | 0 | C05 | Max | 28 | 72 | 11 | 456 | 1,942 | 10,589 |
| G08 | 138 | C05 | Max | 28 | 79 | 11 | 456 | 2,562 | 1,058 |
| G08 | 0 | C05 | Min | -28 | 48 | -11 | -462 | -1,949 | 6,827 |
| G08 | 138 | C05 | Min | -28 | 54 | -11 | -462 | -2,553 | -1,059 |
| G09 | 0 | C05 | Max | 68 | -26 | 7 | 154 | 2,518 | 536 |
| G09 | 146 | C05 | Max | 68 | -20 | 7 | 154 | 1,957 | 5,349 |
| G09 | 0 | C05 | Min | -68 | -40 | -7 | -155 | -2,519 | -531 |
| G09 | 146 | C05 | Min | -68 | -34 | -7 | -155 | -1,956 | 3,383 |
| G10 | 0 | C05 | Max | 60 | -22 | 7 | 154 | 1,957 | 5,349 |
| G10 | 138 | C05 | Max | 60 | -16 | 7 | 154 | 1,671 | 9,262 |
| G10 | 0 | C05 | Min | -60 | -32 | -7 | -155 | -1,956 | 3,383 |
| G10 | 138 | C05 | Min | -60 | -27 | -7 | -155 | -1,669 | 6,136 |
| G11 | 0 | C05 | Max | 51 | -17 | 7 | 154 | 1,671 | 9,262 |
| G11 | 174.5 | C05 | Max | 51 | -10 | 7 | 154 | 1,237 | 12,901 |
| G11 | 0 | C05 | Min | -51 | -26 | -7 | -155 | -1,669 | 6,136 |
| G11 | 174.5 | C05 | Min | -51 | -19 | -7 | -155 | -1,233 | 8,723 |
| G12 | 0 | C05 | Max | 45 | -10 | 8 | 154 | 1,237 | 12,901 |
| G12 | 36.5 | C05 | Max | 45 | -9 | 8 | 154 | 1,204 | 13,479 |
| G12 | 0 | C05 | Min | -46 | -19 | -8 | -155 | -1,233 | 8,723 |
| G12 | 36.5 | C05 | Min | -46 | -17 | -8 | -155 | -1,199 | 9,136 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C05 | Max | 41 | -8 | 9 | 154 | 1,204 | 13,479 |
| G13 | 138 | C05 | Max | 41 | -3 | 9 | 154 | 1,291 | 15,127 |
| G13 | 0 | C05 | Min | -41 | -18 | -9 | -155 | -1,199 | 9,136 |
| G13 | 138 | C05 | Min | -41 | -12 | -9 | -155 | -1,285 | 10,261 |
| G14 | 0 | C05 | Max | 36 | -2 | 9 | 154 | 1,291 | 15,127 |
| G14 | 73 | C05 | Max | 36 | 1 | 9 | 154 | 1,609 | 15,718 |
| G14 | 0 | C05 | Min | -36 | -13 | -9 | -155 | -1,285 | 10,261 |
| G14 | 73 | C05 | Min | -36 | -10 | -9 | -155 | -1,602 | 10,515 |
| G15 | 0 | C05 | Max | 28 | 37 | 9 | 405 | 1,609 | 15,467 |
| G15 | 146 | C05 | Max | 28 | 43 | 9 | 405 | 1,934 | 10,196 |
| G15 | 0 | C05 | Min | -28 | 23 | -9 | -408 | -1,602 | 10,766 |
| G15 | 146 | C05 | Min | -28 | 29 | -9 | -408 | -1,920 | 6,469 |
| G16 | 0 | C05 | Max | 24 | 70 | 11 | 480 | 1,934 | 10,196 |
| G16 | 138 | C05 | Max | 24 | 75 | 11 | 480 | 2,537 | 1,030 |
| G16 | 0 | C05 | Min | -25 | 46 | -11 | -474 | -1,920 | 6,469 |
| G16 | 138 | C05 | Min | -25 | 51 | -11 | -474 | -2,538 | -1,028 |
| | **Girders** | **C05** | **MAX:** | **79** | **79** | **11** | **480** | **2,562** | **15,718** |

**Case-05: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **End Ties** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| ET1 | 0 | C05 | Max | 11 | -1 | 8 | 0 | 953 | -8 |
| ET1 | 120 | C05 | Max | 11 | 1 | 8 | 0 | 83 | 71 |
| ET1 | 0 | C05 | Min | -11 | -2 | -8 | 0 | -967 | -97 |
| ET1 | 120 | C05 | Min | -11 | -1 | -8 | 0 | -84 | -18 |
| ET2 | 0 | C05 | Max | 9 | 1 | 8 | 0 | 83 | 71 |
| ET2 | 120 | C05 | Max | 9 | 2 | 8 | 0 | 976 | -8 |
| ET2 | 0 | C05 | Min | -9 | -1 | -8 | 0 | -84 | -18 |
| ET2 | 120 | C05 | Min | -9 | 1 | -8 | 0 | -964 | -97 |
| ET3 | 0 | C05 | Max | 12 | -1 | 22 | 0 | 2,568 | -8 |
| ET3 | 120 | C05 | Max | 12 | 1 | 22 | 0 | 79 | 71 |
| ET3 | 0 | C05 | Min | -12 | -2 | -21 | 0 | -2,560 | -96 |
| ET3 | 120 | C05 | Min | -12 | -1 | -21 | 0 | -75 | -18 |
| ET4 | 0 | C05 | Max | 11 | 1 | 21 | 0 | 79 | 71 |
| ET4 | 120 | C05 | Max | 11 | 2 | 21 | 0 | 2,543 | -8 |
| ET4 | 0 | C05 | Min | -10 | -1 | -21 | 0 | -75 | -18 |
| ET4 | 120 | C05 | Min | -10 | 1 | -21 | 0 | -2,543 | -97 |
| | **End Ties** | **C05** | **MAX:** | **12** | **2** | **22** | **0** | **2,568** | **97** |

**Case-05: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **Trucks** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| TK1 | 0 | C05 | Max | 19 | -7 | 55 | 923 | 0 | 323 |
| TK1 | 36 | C05 | Max | 19 | -5 | 55 | 923 | 1,981 | 928 |
| TK1 | 0 | C05 | Min | -19 | -32 | -55 | -925 | 0 | -323 |
| TK1 | 36 | C05 | Min | -19 | -30 | -55 | -925 | -1,985 | 389 |
| TK2 | 0 | C05 | Max | 1 | 31 | 48 | 813 | 1,731 | 1,169 |
| TK2 | 36 | C05 | Max | 1 | 33 | 48 | 813 | 0 | 0 |
| TK2 | 0 | C05 | Min | -1 | 6 | -48 | -815 | -1,725 | 253 |
| TK2 | 36 | C05 | Min | -1 | 8 | -48 | -815 | 0 | 0 |
| TK3 | 0 | C05 | Max | 1 | -10 | 42 | 710 | 0 | 0 |
| TK3 | 36 | C05 | Max | 1 | -8 | 42 | 710 | 1,511 | 1,025 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C05 | Min | -1 | -29 | -42 | -713 | 0 | 0 |
| TK3 | 36 | C05 | Min | -1 | -27 | -42 | -713 | -1,519 | 328 |
| TK4 | 0 | C05 | Max | 1 | 24 | 48 | 813 | 1,735 | 912 |
| TK4 | 36 | C05 | Max | 1 | 26 | 48 | 813 | 0 | 0 |
| TK4 | 0 | C05 | Min | -1 | 8 | -48 | -815 | -1,730 | 336 |
| TK4 | 36 | C05 | Min | -1 | 10 | -48 | -815 | 0 | 0 |
| TK5 | 0 | C05 | Max | 22 | -18 | 2 | 1 | 0 | 382 |
| TK5 | 36 | C05 | Max | 22 | -16 | 2 | 1 | 63 | 1,623 |
| TK5 | 0 | C05 | Min | -22 | -52 | -2 | -1 | 0 | -383 |
| TK5 | 36 | C05 | Min | -22 | -50 | -2 | -1 | -63 | 828 |
| TK6 | 0 | C05 | Max | 1 | 48 | 2 | 0 | 58 | 1,779 |
| TK6 | 36 | C05 | Max | 1 | 50 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C05 | Min | -1 | 21 | -2 | 0 | -58 | 776 |
| TK6 | 36 | C05 | Min | -1 | 23 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C05 | Max | 1 | -27 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C05 | Max | 1 | -25 | 2 | 0 | 57 | 1,522 |
| TK7 | 0 | C05 | Min | -1 | -43 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C05 | Min | -1 | -41 | -2 | 0 | -57 | 922 |
| TK8 | 0 | C05 | Max | 1 | 41 | 2 | 0 | 58 | 1,529 |
| TK8 | 36 | C05 | Max | 1 | 43 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C05 | Min | -1 | 22 | -2 | 0 | -58 | 811 |
| TK8 | 36 | C05 | Min | -1 | 24 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C05** | **MAX:** | **22** | **52** | **55** | **925** | **1,985** | **1,779** |

## D.6 Case-06

| Case-06: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C06 | Max | 81 | -21 | 7 | 71 | 2,146 | 462 |
| G01 | 146 | C06 | Max | 81 | -14 | 7 | 71 | 1,767 | 4,342 |
| G01 | 0 | C06 | Min | -81 | -33 | -7 | -70 | -2,143 | -467 |
| G01 | 146 | C06 | Min | -81 | -27 | -7 | -70 | -1,765 | 2,560 |
| G02 | 0 | C06 | Max | 71 | -16 | 6 | 71 | 1,767 | 4,342 |
| G02 | 138 | C06 | Max | 71 | -10 | 6 | 71 | 1,627 | 7,182 |
| G02 | 0 | C06 | Min | -71 | -24 | -6 | -70 | -1,765 | 2,560 |
| G02 | 138 | C06 | Min | -71 | -18 | -6 | -70 | -1,625 | 4,466 |
| G03 | 0 | C06 | Max | 61 | -11 | 5 | 71 | 1,627 | 7,182 |
| G03 | 174.5 | C06 | Max | 61 | -3 | 5 | 71 | 1,220 | 9,228 |
| G03 | 0 | C06 | Min | -61 | -17 | -5 | -70 | -1,625 | 4,466 |
| G03 | 174.5 | C06 | Min | -61 | -9 | -5 | -70 | -1,219 | 5,945 |
| G04 | 0 | C06 | Max | 54 | -3 | 6 | 71 | 1,220 | 9,228 |
| G04 | 36.5 | C06 | Max | 54 | -2 | 6 | 71 | 1,150 | 9,455 |
| G04 | 0 | C06 | Min | -54 | -9 | -6 | -70 | -1,219 | 5,945 |
| G04 | 36.5 | C06 | Min | -54 | -7 | -6 | -70 | -1,149 | 6,105 |
| G05 | 0 | C06 | Max | 49 | -1 | 7 | 71 | 1,150 | 9,455 |
| G05 | 129.5 | C06 | Max | 49 | 4 | 7 | 71 | 895 | 9,677 |
| G05 | 0 | C06 | Min | -49 | -8 | -7 | -70 | -1,149 | 6,105 |
| G05 | 129.5 | C06 | Min | -49 | -2 | -7 | -70 | -895 | 6,279 |
| G06 | 0 | C06 | Max | 43 | 4 | 8 | 71 | 895 | 9,677 |
| G06 | 81.5 | C06 | Max | 43 | 8 | 8 | 71 | 1,040 | 9,357 |
| G06 | 0 | C06 | Min | -43 | -2 | -8 | -70 | -895 | 6,279 |
| G06 | 81.5 | C06 | Min | -43 | 2 | -8 | -70 | -1,040 | 6,066 |
| G07 | 0 | C06 | Max | 36 | 9 | 10 | 71 | 1,040 | 9,357 |
| G07 | 138 | C06 | Max | 36 | 15 | 10 | 71 | 1,904 | 8,160 |
| G07 | 0 | C06 | Min | -36 | 2 | -10 | -70 | -1,040 | 6,066 |
| G07 | 138 | C06 | Min | -36 | 8 | -10 | -70 | -1,906 | 4,984 |
| G08 | 0 | C06 | Max | 27 | 51 | 9 | 384 | 1,904 | 7,967 |
| G08 | 146 | C06 | Max | 27 | 58 | 9 | 384 | 2,467 | 993 |
| G08 | 0 | C06 | Min | -27 | 32 | -9 | -385 | -1,906 | 5,177 |
| G08 | 146 | C06 | Min | -27 | 39 | -9 | -385 | -2,462 | -994 |
| G09 | 0 | C06 | Max | 68 | -20 | 7 | 77 | 2,019 | 452 |
| G09 | 146 | C06 | Max | 68 | -14 | 7 | 77 | 1,747 | 3,941 |
| G09 | 0 | C06 | Min | -68 | -30 | -7 | -78 | -2,020 | -447 |
| G09 | 146 | C06 | Min | -68 | -24 | -7 | -78 | -1,747 | 2,506 |
| G10 | 0 | C06 | Max | 60 | -15 | 6 | 77 | 1,747 | 3,941 |
| G10 | 138 | C06 | Max | 60 | -10 | 6 | 77 | 1,567 | 6,607 |
| G10 | 0 | C06 | Min | -60 | -23 | -6 | -78 | -1,747 | 2,506 |
| G10 | 138 | C06 | Min | -60 | -17 | -6 | -78 | -1,566 | 4,344 |
| G11 | 0 | C06 | Max | 51 | -11 | 5 | 77 | 1,567 | 6,607 |
| G11 | 174.5 | C06 | Max | 51 | -4 | 5 | 77 | 1,123 | 8,711 |
| G11 | 0 | C06 | Min | -51 | -16 | -5 | -78 | -1,566 | 4,344 |
| G11 | 174.5 | C06 | Min | -51 | -9 | -5 | -78 | -1,120 | 5,732 |
| G12 | 0 | C06 | Max | 46 | -4 | 6 | 77 | 1,123 | 8,711 |
| G12 | 36.5 | C06 | Max | 46 | -3 | 6 | 77 | 1,061 | 8,958 |
| G12 | 0 | C06 | Min | -46 | -9 | -6 | -78 | -1,120 | 5,732 |
| G12 | 36.5 | C06 | Min | -46 | -7 | -6 | -78 | -1,058 | 5,905 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C06 | Max | 41 | -3 | 7 | 77 | 1,061 | 8,958 |
| G13 | 129.5 | C06 | Max | 41 | 3 | 7 | 77 | 839 | 9,349 |
| G13 | 0 | C06 | Min | -41 | -7 | -7 | -78 | -1,058 | 5,905 |
| G13 | 129.5 | C06 | Min | -41 | -2 | -7 | -78 | -835 | 6,134 |
| G14 | 0 | C06 | Max | 36 | 3 | 7 | 77 | 839 | 9,349 |
| G14 | 81.5 | C06 | Max | 36 | 6 | 7 | 77 | 1,021 | 9,205 |
| G14 | 0 | C06 | Min | -36 | -2 | -7 | -78 | -835 | 6,134 |
| G14 | 81.5 | C06 | Min | -36 | 1 | -7 | -78 | -1,016 | 5,973 |
| G15 | 0 | C06 | Max | 32 | 7 | 9 | 77 | 1,021 | 9,205 |
| G15 | 138 | C06 | Max | 32 | 13 | 9 | 77 | 1,896 | 8,248 |
| G15 | 0 | C06 | Min | -32 | 0 | -9 | -78 | -1,016 | 5,973 |
| G15 | 138 | C06 | Min | -32 | 5 | -9 | -78 | -1,889 | 5,190 |
| G16 | 0 | C06 | Max | 24 | 54 | 9 | 452 | 1,896 | 8,007 |
| G16 | 146 | C06 | Max | 24 | 59 | 9 | 452 | 2,465 | 994 |
| G16 | 0 | C06 | Min | -24 | 33 | -9 | -451 | -1,889 | 5,431 |
| G16 | 146 | C06 | Min | -24 | 39 | -9 | -451 | -2,464 | -993 |
| | **Girders** | **C06** | **MAX:** | **81** | **59** | **10** | **452** | **2,467** | **9,677** |

**Case-06: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| End Ties | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | C06 | Max | 11 | -1 | 6 | 0 | 790 | -39 |
| ET1 | 120 | C06 | Max | 11 | 0 | 6 | 0 | 100 | 39 |
| ET1 | 0 | C06 | Min | -11 | -2 | -7 | 0 | -802 | -66 |
| ET1 | 120 | C06 | Min | -11 | 0 | -7 | 0 | -100 | 14 |
| ET2 | 0 | C06 | Max | 10 | 0 | 7 | 0 | 100 | 39 |
| ET2 | 120 | C06 | Max | 10 | 2 | 7 | 0 | 781 | -39 |
| ET2 | 0 | C06 | Min | -10 | 0 | -7 | 0 | -100 | 14 |
| ET2 | 120 | C06 | Min | -10 | 1 | -7 | 0 | -769 | -66 |
| ET3 | 0 | C06 | Max | 6 | -1 | 21 | 0 | 2,468 | -36 |
| ET3 | 120 | C06 | Max | 6 | 0 | 21 | 0 | 75 | 42 |
| ET3 | 0 | C06 | Min | -1 | -2 | -20 | 0 | -2,463 | -69 |
| ET3 | 120 | C06 | Min | -1 | 0 | -20 | 0 | -73 | 11 |
| ET4 | 0 | C06 | Max | 6 | 0 | 21 | 0 | 75 | 42 |
| ET4 | 120 | C06 | Max | 6 | 2 | 21 | 0 | 2,467 | -37 |
| ET4 | 0 | C06 | Min | 0 | 0 | -21 | 0 | -73 | 11 |
| ET4 | 120 | C06 | Min | 0 | 1 | -21 | 0 | -2,468 | -68 |
| | **End Ties** | **C06** | **MAX:** | **11** | **2** | **21** | **0** | **2,468** | **69** |

**Case-06: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | C06 | Max | 19 | -6 | 52 | 882 | 0 | 331 |
| TK1 | 36 | C06 | Max | 19 | -4 | 52 | 882 | 1,881 | 693 |
| TK1 | 0 | C06 | Min | -19 | -25 | -52 | -883 | 0 | -331 |
| TK1 | 36 | C06 | Min | -19 | -23 | -52 | -883 | -1,884 | 344 |
| TK2 | 0 | C06 | Max | 1 | 25 | 46 | 781 | 1,664 | 930 |
| TK2 | 36 | C06 | Max | 1 | 27 | 46 | 781 | 0 | 0 |
| TK2 | 0 | C06 | Min | -1 | 5 | -46 | -784 | -1,658 | 211 |
| TK2 | 36 | C06 | Min | -1 | 7 | -46 | -784 | 0 | 0 |
| TK3 | 0 | C06 | Max | 1 | -9 | 41 | 692 | 0 | 0 |
| TK3 | 36 | C06 | Max | 1 | -7 | 41 | 692 | 1,462 | 771 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C06 | Min | -1 | -22 | -41 | -695 | 0 | 0 |
| TK3 | 36 | C06 | Min | -1 | -20 | -41 | -695 | -1,470 | 300 |
| TK4 | 0 | C06 | Max | 1 | 19 | 46 | 777 | 1,666 | 703 |
| TK4 | 36 | C06 | Max | 1 | 21 | 46 | 777 | 0 | 0 |
| TK4 | 0 | C06 | Min | -1 | 6 | -46 | -779 | -1,661 | 263 |
| TK4 | 36 | C06 | Min | -1 | 8 | -46 | -779 | 0 | 0 |
| TK5 | 0 | C06 | Max | 18 | -24 | 2 | 1 | 0 | 299 |
| TK5 | 36 | C06 | Max | 18 | -22 | 2 | 1 | 59 | 1,733 |
| TK5 | 0 | C06 | Min | -18 | -54 | -2 | -1 | 0 | -299 |
| TK5 | 36 | C06 | Min | -18 | -52 | -2 | -1 | -59 | 1,024 |
| TK6 | 0 | C06 | Max | 1 | 53 | 2 | 0 | 59 | 1,945 |
| TK6 | 36 | C06 | Max | 1 | 55 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C06 | Min | -1 | 23 | -2 | 0 | -59 | 864 |
| TK6 | 36 | C06 | Min | -1 | 25 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C06 | Max | 1 | -30 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C06 | Max | 1 | -28 | 2 | 0 | 57 | 1,664 |
| TK7 | 0 | C06 | Min | -1 | -47 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C06 | Min | -1 | -45 | -2 | 0 | -57 | 1,036 |
| TK8 | 0 | C06 | Max | 1 | 45 | 2 | 0 | 57 | 1,641 |
| TK8 | 36 | C06 | Max | 1 | 47 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C06 | Min | -1 | 27 | -2 | 0 | -57 | 1,007 |
| TK8 | 36 | C06 | Min | -1 | 29 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C06** | **MAX:** | **19** | **55** | **52** | **883** | **1,884** | **1,945** |

## D.7 Case-07

| Case-07: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C07 | Max | 78 | -43 | 10 | 515 | 2,555 | 496 |
| G01 | 146 | C07 | Max | 78 | -37 | 10 | 515 | 1,137 | 24,390 |
| G01 | 0 | C07 | Min | -78 | -171 | -10 | -513 | -2,540 | -504 |
| G01 | 146 | C07 | Min | -78 | -164 | -10 | -513 | -1,128 | 5,842 |
| G02 | 0 | C07 | Max | 69 | -38 | 12 | 515 | 1,137 | 24,390 |
| G02 | 138 | C07 | Max | 69 | -31 | 12 | 515 | 606 | 46,392 |
| G02 | 0 | C07 | Min | -68 | -163 | -12 | -513 | -1,128 | 5,842 |
| G02 | 138 | C07 | Min | -68 | -157 | -12 | -513 | -604 | 10,642 |
| G03 | 0 | C07 | Max | 59 | -33 | 12 | 515 | 606 | 46,392 |
| G03 | 174.5 | C07 | Max | 59 | -25 | 12 | 515 | 2,519 | 72,661 |
| G03 | 0 | C07 | Min | -59 | -155 | -12 | -513 | -604 | 10,642 |
| G03 | 174.5 | C07 | Min | -59 | -147 | -12 | -513 | -2,524 | 15,785 |
| G04 | 0 | C07 | Max | 48 | 15 | 2 | 158 | 2,519 | 72,675 |
| G04 | 36.5 | C07 | Max | 48 | 16 | 2 | 158 | 2,471 | 72,137 |
| G04 | 0 | C07 | Min | -48 | 2 | -2 | -156 | -2,524 | 15,771 |
| G04 | 36.5 | C07 | Min | -48 | 3 | -2 | -156 | -2,477 | 15,650 |
| G05 | 0 | C07 | Max | 43 | 18 | 3 | 158 | 2,471 | 72,137 |
| G05 | 109.5 | C07 | Max | 43 | 23 | 3 | 158 | 2,253 | 70,042 |
| G05 | 0 | C07 | Min | -43 | 2 | -3 | -156 | -2,477 | 15,650 |
| G05 | 109.5 | C07 | Min | -43 | 7 | -3 | -156 | -2,262 | 15,041 |
| G06 | 0 | C07 | Max | 37 | 172 | 12 | 577 | 2,253 | 70,042 |
| G06 | 101.5 | C07 | Max | 37 | 176 | 12 | 577 | 1,179 | 52,400 |
| G06 | 0 | C07 | Min | -37 | 31 | -12 | -581 | -2,262 | 15,041 |
| G06 | 101.5 | C07 | Min | -37 | 36 | -12 | -581 | -1,183 | 11,591 |
| G07 | 0 | C07 | Max | 30 | 178 | 11 | 577 | 1,179 | 52,400 |
| G07 | 138 | C07 | Max | 30 | 184 | 11 | 577 | 586 | 27,544 |
| G07 | 0 | C07 | Min | -30 | 35 | -12 | -581 | -1,183 | 11,591 |
| G07 | 138 | C07 | Min | -30 | 41 | -12 | -581 | -581 | 6,268 |
| G08 | 0 | C07 | Max | 23 | 185 | 10 | 577 | 586 | 27,544 |
| G08 | 146 | C07 | Max | 23 | 191 | 10 | 577 | 1,872 | 778 |
| G08 | 0 | C07 | Min | -23 | 40 | -10 | -581 | -581 | 6,268 |
| G08 | 146 | C07 | Min | -23 | 47 | -10 | -581 | -1,859 | -781 |
| G09 | 0 | C07 | Max | 70 | -42 | 10 | 511 | 2,548 | 546 |
| G09 | 146 | C07 | Max | 70 | -36 | 10 | 511 | 1,116 | 23,963 |
| G09 | 0 | C07 | Min | -70 | -167 | -10 | -513 | -2,555 | -537 |
| G09 | 146 | C07 | Min | -70 | -162 | -10 | -513 | -1,116 | 5,696 |
| G10 | 0 | C07 | Max | 61 | -37 | 12 | 511 | 1,116 | 23,963 |
| G10 | 138 | C07 | Max | 61 | -31 | 12 | 511 | 597 | 45,706 |
| G10 | 0 | C07 | Min | -61 | -161 | -12 | -513 | -1,116 | 5,696 |
| G10 | 138 | C07 | Min | -61 | -155 | -12 | -513 | -591 | 10,397 |
| G11 | 0 | C07 | Max | 52 | -32 | 12 | 511 | 597 | 45,706 |
| G11 | 174.5 | C07 | Max | 52 | -25 | 12 | 511 | 2,513 | 71,845 |
| G11 | 0 | C07 | Min | -52 | -154 | -12 | -513 | -591 | 10,397 |
| G11 | 174.5 | C07 | Min | -52 | -146 | -12 | -513 | -2,498 | 15,491 |
| G12 | 0 | C07 | Max | 43 | 16 | 2 | 145 | 2,513 | 71,801 |
| G12 | 36.5 | C07 | Max | 43 | 17 | 2 | 145 | 2,464 | 71,234 |
| G12 | 0 | C07 | Min | -43 | 2 | -2 | -146 | -2,498 | 15,535 |
| G12 | 36.5 | C07 | Min | -43 | 4 | -2 | -146 | -2,448 | 15,385 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C07 | Max | 39 | 18 | 3 | 145 | 2,464 | 71,234 |
| G13 | 109.5 | C07 | Max | 39 | 23 | 3 | 145 | 2,263 | 69,095 |
| G13 | 0 | C07 | Min | -39 | 3 | -3 | -146 | -2,448 | 15,385 |
| G13 | 109.5 | C07 | Min | -39 | 7 | -3 | -146 | -2,243 | 14,728 |
| G14 | 0 | C07 | Max | 34 | 170 | 11 | 569 | 2,263 | 69,095 |
| G14 | 101.5 | C07 | Max | 34 | 174 | 11 | 569 | 1,175 | 51,621 |
| G14 | 0 | C07 | Min | -34 | 31 | -11 | -566 | -2,243 | 14,728 |
| G14 | 101.5 | C07 | Min | -34 | 36 | -11 | -566 | -1,160 | 11,297 |
| G15 | 0 | C07 | Max | 27 | 176 | 11 | 569 | 1,175 | 51,621 |
| G15 | 138 | C07 | Max | 27 | 181 | 11 | 569 | 540 | 27,041 |
| G15 | 0 | C07 | Min | -27 | 34 | -11 | -566 | -1,160 | 11,297 |
| G15 | 138 | C07 | Min | -27 | 40 | -11 | -566 | -533 | 6,120 |
| G16 | 0 | C07 | Max | 20 | 182 | 10 | 569 | 540 | 27,041 |
| G16 | 146 | C07 | Max | 20 | 188 | 10 | 569 | 1,854 | 739 |
| G16 | 0 | C07 | Min | -20 | 39 | -10 | -566 | -533 | 6,120 |
| G16 | 146 | C07 | Min | -20 | 45 | -10 | -566 | -1,854 | -737 |
| | **Girders** | **C07** | **MAX:** | **78** | **191** | **12** | **581** | **2,555** | **72,675** |

**Case-07: Element Forces - Frames**

| Frame End Ties | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| ET1 | 0 | C07 | Max | 8 | -1 | 9 | 0 | 1,081 | -25 |
| ET1 | 120 | C07 | Max | 8 | 0 | 9 | 0 | 68 | 54 |
| ET1 | 0 | C07 | Min | -8 | -2 | -9 | 0 | -1,104 | -80 |
| ET1 | 120 | C07 | Min | -8 | 0 | -9 | 0 | -71 | -2 |
| ET2 | 0 | C07 | Max | 8 | 0 | 9 | 0 | 68 | 54 |
| ET2 | 120 | C07 | Max | 8 | 2 | 9 | 0 | 1,101 | -22 |
| ET2 | 0 | C07 | Min | -8 | 0 | -9 | 0 | -71 | -2 |
| ET2 | 120 | C07 | Min | -8 | 1 | -9 | 0 | -1,083 | -83 |
| ET3 | 0 | C07 | Max | 13 | -1 | 16 | 0 | 1,876 | -23 |
| ET3 | 120 | C07 | Max | 13 | 0 | 16 | 0 | 107 | 57 |
| ET3 | 0 | C07 | Min | -13 | -2 | -16 | 0 | -1,863 | -82 |
| ET3 | 120 | C07 | Min | -13 | 0 | -16 | 0 | -100 | -4 |
| ET4 | 0 | C07 | Max | 11 | 1 | 16 | 0 | 107 | 57 |
| ET4 | 120 | C07 | Max | 11 | 2 | 16 | 0 | 1,858 | -19 |
| ET4 | 0 | C07 | Min | -11 | -1 | -15 | 0 | -100 | -4 |
| ET4 | 120 | C07 | Min | -11 | 1 | -15 | 0 | -1,858 | -86 |
| | **End Ties** | **C07** | **MAX:** | **13** | **2** | **16** | **0** | **1,876** | **86** |

**Case-07: Element Forces - Frames**

| Frame Trucks | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| TK1 | 0 | C07 | Max | 16 | -20 | 43 | 732 | 0 | 273 |
| TK1 | 36 | C07 | Max | 16 | -18 | 43 | 732 | 1,545 | 3,204 |
| TK1 | 0 | C07 | Min | -16 | -91 | -43 | -732 | 0 | -273 |
| TK1 | 36 | C07 | Min | -16 | -89 | -43 | -732 | -1,547 | 709 |
| TK2 | 0 | C07 | Max | 1 | 91 | 50 | 842 | 1,792 | 3,326 |
| TK2 | 36 | C07 | Max | 1 | 93 | 50 | 842 | 0 | 0 |
| TK2 | 0 | C07 | Min | -1 | 18 | -50 | -845 | -1,785 | 692 |
| TK2 | 36 | C07 | Min | -1 | 20 | -50 | -845 | 0 | 0 |
| TK3 | 0 | C07 | Max | 1 | -21 | 46 | 765 | 0 | 0 |
| TK3 | 36 | C07 | Max | 1 | -19 | 46 | 765 | 1,624 | 3,212 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C07 | Min | -1 | -90 | -45 | -772 | 0 | 0 |
| TK3 | 36 | C07 | Min | -1 | -88 | -45 | -772 | -1,639 | 720 |
| TK4 | 0 | C07 | Max | 1 | 86 | 43 | 729 | 1,536 | 3,122 |
| TK4 | 36 | C07 | Max | 1 | 88 | 43 | 729 | 0 | 0 |
| TK4 | 0 | C07 | Min | -1 | 19 | -42 | -734 | -1,525 | 706 |
| TK4 | 36 | C07 | Min | -1 | 21 | -42 | -734 | 0 | 0 |
| TK5 | 0 | C07 | Max | 25 | -22 | 2 | 1 | 0 | 423 |
| TK5 | 36 | C07 | Max | 25 | -20 | 2 | 1 | 58 | 3,582 |
| TK5 | 0 | C07 | Min | -25 | -101 | -2 | -1 | 0 | -423 |
| TK5 | 36 | C07 | Min | -25 | -99 | -2 | -1 | -58 | 772 |
| TK6 | 0 | C07 | Max | 1 | 101 | 2 | 0 | 58 | 3,688 |
| TK6 | 36 | C07 | Max | 1 | 103 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C07 | Min | -1 | 20 | -2 | 0 | -58 | 771 |
| TK6 | 36 | C07 | Min | -1 | 22 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C07 | Max | 1 | -23 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C07 | Max | 1 | -21 | 2 | 0 | 61 | 3,572 |
| TK7 | 0 | C07 | Min | -1 | -100 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C07 | Min | -1 | -98 | -2 | 0 | -61 | 792 |
| TK8 | 0 | C07 | Max | 1 | 97 | 2 | 0 | 57 | 3,529 |
| TK8 | 36 | C07 | Max | 1 | 99 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C07 | Min | -1 | 19 | -2 | 0 | -57 | 731 |
| TK8 | 36 | C07 | Min | -1 | 21 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C07** | **MAX:** | **25** | **103** | **50** | **845** | **1,792** | **3,688** |

## D.8 Case-08

| Case-08: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C08 | Max | 80 | -35 | 7 | 138 | 2,442 | 543 |
| G01 | 146 | C08 | Max | 80 | -28 | 7 | 138 | 2,009 | 12,344 |
| G01 | 0 | C08 | Min | -79 | -88 | -7 | -136 | -2,436 | -548 |
| G01 | 146 | C08 | Min | -79 | -81 | -7 | -136 | -2,005 | 4,610 |
| G02 | 0 | C08 | Max | 71 | -31 | 7 | 138 | 2,009 | 12,344 |
| G02 | 138 | C08 | Max | 71 | -25 | 7 | 138 | 1,701 | 22,699 |
| G02 | 0 | C08 | Min | -71 | -79 | -7 | -136 | -2,005 | 4,610 |
| G02 | 138 | C08 | Min | -71 | -72 | -7 | -136 | -1,698 | 8,503 |
| G03 | 0 | C08 | Max | 62 | -26 | 7 | 138 | 1,701 | 22,699 |
| G03 | 174.5 | C08 | Max | 62 | -18 | 7 | 138 | 1,299 | 34,169 |
| G03 | 0 | C08 | Min | -62 | -71 | -7 | -136 | -1,698 | 8,503 |
| G03 | 174.5 | C08 | Min | -62 | -63 | -7 | -136 | -1,297 | 12,570 |
| G04 | 0 | C08 | Max | 56 | -18 | 7 | 138 | 1,299 | 34,169 |
| G04 | 36.5 | C08 | Max | 56 | -16 | 7 | 138 | 1,244 | 36,352 |
| G04 | 0 | C08 | Min | -56 | -63 | -7 | -136 | -1,297 | 12,570 |
| G04 | 36.5 | C08 | Min | -56 | -61 | -7 | -136 | -1,243 | 13,288 |
| G05 | 0 | C08 | Max | 51 | -16 | 9 | 138 | 1,244 | 36,352 |
| G05 | 138 | C08 | Max | 51 | -10 | 9 | 138 | 1,252 | 44,078 |
| G05 | 0 | C08 | Min | -51 | -62 | -9 | -136 | -1,243 | 13,288 |
| G05 | 138 | C08 | Min | -51 | -56 | -9 | -136 | -1,252 | 15,432 |
| G06 | 0 | C08 | Max | 45 | -10 | 9 | 138 | 1,252 | 44,078 |
| G06 | 73 | C08 | Max | 45 | -7 | 9 | 138 | 1,525 | 47,757 |
| G06 | 0 | C08 | Min | -45 | -55 | -9 | -136 | -1,252 | 15,432 |
| G06 | 73 | C08 | Min | -45 | -52 | -9 | -136 | -1,526 | 16,273 |
| G07 | 0 | C08 | Max | 35 | 95 | 9 | 347 | 1,525 | 47,750 |
| G07 | 146 | C08 | Max | 35 | 101 | 9 | 347 | 1,933 | 33,515 |
| G07 | 0 | C08 | Min | -35 | 32 | -9 | -329 | -1,526 | 16,281 |
| G07 | 146 | C08 | Min | -35 | 39 | -9 | -329 | -1,977 | 11,048 |
| G08 | 0 | C08 | Max | 28 | 238 | 11 | 436 | 1,933 | 33,515 |
| G08 | 138 | C08 | Max | 28 | 244 | 11 | 436 | 2,583 | 1,054 |
| G08 | 0 | C08 | Min | -28 | 78 | -11 | -461 | -1,977 | 11,048 |
| G08 | 138 | C08 | Min | -28 | 85 | -11 | -461 | -2,563 | -1,056 |
| G09 | 0 | C08 | Max | 67 | -34 | 8 | 152 | 2,541 | 568 |
| G09 | 146 | C08 | Max | 67 | -28 | 8 | 152 | 2,004 | 11,881 |
| G09 | 0 | C08 | Min | -67 | -85 | -8 | -154 | -2,546 | -563 |
| G09 | 146 | C08 | Min | -67 | -79 | -8 | -154 | -2,006 | 4,630 |
| G10 | 0 | C08 | Max | 60 | -30 | 7 | 152 | 2,004 | 11,881 |
| G10 | 138 | C08 | Max | 60 | -24 | 7 | 152 | 1,724 | 22,062 |
| G10 | 0 | C08 | Min | -60 | -78 | -7 | -154 | -2,006 | 4,630 |
| G10 | 138 | C08 | Min | -60 | -72 | -7 | -154 | -1,723 | 8,468 |
| G11 | 0 | C08 | Max | 52 | -25 | 7 | 152 | 1,724 | 22,062 |
| G11 | 174.5 | C08 | Max | 52 | -18 | 7 | 152 | 1,237 | 33,696 |
| G11 | 0 | C08 | Min | -52 | -71 | -7 | -154 | -1,723 | 8,468 |
| G11 | 174.5 | C08 | Min | -52 | -64 | -7 | -154 | -1,233 | 12,358 |
| G12 | 0 | C08 | Max | 46 | -18 | 8 | 152 | 1,237 | 33,696 |
| G12 | 36.5 | C08 | Max | 46 | -17 | 8 | 152 | 1,173 | 35,951 |
| G12 | 0 | C08 | Min | -46 | -64 | -8 | -154 | -1,233 | 12,358 |
| G12 | 36.5 | C08 | Min | -46 | -62 | -8 | -154 | -1,168 | 13,039 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C08 | Max | 42 | -17 | 9 | 152 | 1,173 | 35,951 |
| G13 | 138 | C08 | Max | 42 | -11 | 9 | 152 | 1,272 | 43,932 |
| G13 | 0 | C08 | Min | -42 | -62 | -9 | -154 | -1,168 | 13,039 |
| G13 | 138 | C08 | Min | -42 | -57 | -9 | -154 | -1,265 | 15,184 |
| G14 | 0 | C08 | Max | 38 | -12 | 10 | 152 | 1,272 | 43,932 |
| G14 | 73 | C08 | Max | 38 | -9 | 10 | 152 | 1,655 | 47,824 |
| G14 | 0 | C08 | Min | -38 | -56 | -10 | -154 | -1,265 | 15,184 |
| G14 | 73 | C08 | Min | -38 | -53 | -10 | -154 | -1,646 | 16,027 |
| G15 | 0 | C08 | Max | 29 | 98 | 10 | 422 | 1,655 | 47,723 |
| G15 | 146 | C08 | Max | 29 | 104 | 10 | 422 | 1,966 | 33,100 |
| G15 | 0 | C08 | Min | -29 | 34 | -10 | -439 | -1,646 | 16,127 |
| G15 | 146 | C08 | Min | -29 | 39 | -10 | -439 | -1,913 | 10,713 |
| G16 | 0 | C08 | Max | 24 | 238 | 11 | 469 | 1,966 | 33,100 |
| G16 | 138 | C08 | Max | 24 | 243 | 11 | 469 | 2,560 | 1,025 |
| G16 | 0 | C08 | Min | -24 | 74 | -10 | -444 | -1,913 | 10,713 |
| G16 | 138 | C08 | Min | -24 | 80 | -10 | -444 | -2,570 | -1,023 |
| | **Girders** | **C08** | **MAX:** | **80** | **244** | **11** | **469** | **2,583** | **47,824** |

**Case-08: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **End Ties** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| ET1 | 0 | C08 | Max | 13 | -1 | 8 | 0 | 940 | -24 |
| ET1 | 120 | C08 | Max | 13 | 0 | 8 | 0 | 86 | 55 |
| ET1 | 0 | C08 | Min | -13 | -2 | -8 | 0 | -953 | -81 |
| ET1 | 120 | C08 | Min | -13 | 0 | -8 | 0 | -87 | -3 |
| ET2 | 0 | C08 | Max | 11 | 0 | 8 | 0 | 86 | 55 |
| ET2 | 120 | C08 | Max | 11 | 2 | 8 | 0 | 965 | -24 |
| ET2 | 0 | C08 | Min | -11 | 0 | -8 | 0 | -87 | -3 |
| ET2 | 120 | C08 | Min | -11 | 1 | -8 | 0 | -953 | -81 |
| ET3 | 0 | C08 | Max | 13 | -1 | 21 | 0 | 2,588 | -25 |
| ET3 | 120 | C08 | Max | 13 | 0 | 21 | 0 | 88 | 54 |
| ET3 | 0 | C08 | Min | -12 | -2 | -21 | 0 | -2,568 | -79 |
| ET3 | 120 | C08 | Min | -12 | 0 | -21 | 0 | -73 | -1 |
| ET4 | 0 | C08 | Max | 11 | 0 | 21 | 0 | 88 | 54 |
| ET4 | 120 | C08 | Max | 11 | 2 | 21 | 0 | 2,574 | -24 |
| ET4 | 0 | C08 | Min | -11 | 0 | -21 | 0 | -73 | -1 |
| ET4 | 120 | C08 | Min | -11 | 1 | -21 | 0 | -2,564 | -81 |
| | **End Ties** | **C08** | **MAX:** | **13** | **2** | **21** | **0** | **2,588** | **81** |

**Case-08: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **Trucks** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| TK1 | 0 | C08 | Max | 24 | -15 | 54 | 902 | 0 | 413 |
| TK1 | 36 | C08 | Max | 24 | -13 | 54 | 902 | 1,941 | 1,648 |
| TK1 | 0 | C08 | Min | -24 | -51 | -54 | -904 | 0 | -412 |
| TK1 | 36 | C08 | Min | -24 | -49 | -54 | -904 | -1,943 | 629 |
| TK2 | 0 | C08 | Max | 1 | 53 | 47 | 800 | 1,697 | 1,934 |
| TK2 | 36 | C08 | Max | 1 | 55 | 47 | 800 | 0 | 0 |
| TK2 | 0 | C08 | Min | -1 | 11 | -47 | -802 | -1,692 | 447 |
| TK2 | 36 | C08 | Min | -1 | 13 | -47 | -802 | 0 | 0 |
| TK3 | 0 | C08 | Max | 1 | -15 | 41 | 693 | 0 | 0 |
| TK3 | 36 | C08 | Max | 1 | -13 | 41 | 693 | 1,477 | 1,795 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C08 | Min | -1 | -51 | -41 | -697 | 0 | 0 |
| TK3 | 36 | C08 | Min | -1 | -49 | -41 | -697 | -1,486 | 516 |
| TK4 | 0 | C08 | Max | 1 | 45 | 49 | 837 | 1,778 | 1,660 |
| TK4 | 36 | C08 | Max | 1 | 47 | 49 | 837 | 0 | 0 |
| TK4 | 0 | C08 | Min | -1 | 14 | -49 | -840 | -1,771 | 547 |
| TK4 | 36 | C08 | Min | -1 | 16 | -49 | -840 | 0 | 0 |
| TK5 | 0 | C08 | Max | 23 | -41 | 2 | 1 | 0 | 403 |
| TK5 | 36 | C08 | Max | 23 | -39 | 2 | 1 | 64 | 4,440 |
| TK5 | 0 | C08 | Min | -23 | -128 | -2 | -1 | 0 | -403 |
| TK5 | 36 | C08 | Min | -23 | -126 | -2 | -1 | -64 | 1,553 |
| TK6 | 0 | C08 | Max | 1 | 131 | 2 | 0 | 64 | 4,753 |
| TK6 | 36 | C08 | Max | 1 | 133 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C08 | Min | -1 | 36 | -2 | 0 | -64 | 1,342 |
| TK6 | 36 | C08 | Min | -1 | 38 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C08 | Max | 1 | -42 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C08 | Max | 1 | -41 | 2 | 0 | 56 | 4,489 |
| TK7 | 0 | C08 | Min | -1 | -126 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C08 | Min | -1 | -124 | -2 | 0 | -56 | 1,495 |
| TK8 | 0 | C08 | Max | 1 | 122 | 2 | 0 | 57 | 4,440 |
| TK8 | 36 | C08 | Max | 1 | 124 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C08 | Min | -1 | 39 | -2 | 0 | -57 | 1,442 |
| TK8 | 36 | C08 | Min | -1 | 41 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C08** | **MAX:** | **24** | **133** | **54** | **904** | **1,943** | **4,753** |

## D.9 Case-09

| Case-09: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C09 | Max | 80 | -27 | 7 | 77 | 2,116 | 449 |
| G01 | 146 | C09 | Max | 80 | -20 | 7 | 77 | 1,746 | 6,259 |
| G01 | 0 | C09 | Min | -80 | -46 | -7 | -74 | -2,112 | -454 |
| G01 | 146 | C09 | Min | -80 | -39 | -7 | -74 | -1,743 | 3,334 |
| G02 | 0 | C09 | Max | 71 | -21 | 6 | 77 | 1,746 | 6,259 |
| G02 | 138 | C09 | Max | 71 | -15 | 6 | 77 | 1,596 | 10,988 |
| G02 | 0 | C09 | Min | -71 | -38 | -6 | -74 | -1,743 | 3,334 |
| G02 | 138 | C09 | Min | -71 | -32 | -6 | -74 | -1,594 | 5,897 |
| G03 | 0 | C09 | Max | 61 | -16 | 5 | 77 | 1,596 | 10,988 |
| G03 | 174.5 | C09 | Max | 61 | -9 | 5 | 77 | 1,195 | 15,501 |
| G03 | 0 | C09 | Min | -61 | -30 | -5 | -74 | -1,594 | 5,897 |
| G03 | 174.5 | C09 | Min | -61 | -22 | -5 | -74 | -1,195 | 8,124 |
| G04 | 0 | C09 | Max | 55 | -9 | 6 | 77 | 1,195 | 15,501 |
| G04 | 36.5 | C09 | Max | 55 | -8 | 6 | 77 | 1,143 | 16,225 |
| G04 | 0 | C09 | Min | -54 | -21 | -6 | -74 | -1,195 | 8,124 |
| G04 | 36.5 | C09 | Min | -54 | -20 | -6 | -74 | -1,144 | 8,460 |
| G05 | 0 | C09 | Max | 50 | -7 | 7 | 77 | 1,143 | 16,225 |
| G05 | 129.5 | C09 | Max | 50 | -2 | 7 | 77 | 887 | 18,203 |
| G05 | 0 | C09 | Min | -50 | -20 | -7 | -74 | -1,144 | 8,460 |
| G05 | 129.5 | C09 | Min | -50 | -14 | -7 | -74 | -890 | 9,265 |
| G06 | 0 | C09 | Max | 44 | -2 | 8 | 77 | 887 | 18,203 |
| G06 | 81.5 | C09 | Max | 44 | 2 | 8 | 77 | 1,037 | 19,008 |
| G06 | 0 | C09 | Min | -44 | -14 | -8 | -74 | -890 | 9,265 |
| G06 | 81.5 | C09 | Min | -44 | -10 | -8 | -74 | -1,040 | 9,430 |
| G07 | 0 | C09 | Max | 37 | 2 | 10 | 77 | 1,037 | 19,008 |
| G07 | 138 | C09 | Max | 37 | 8 | 10 | 77 | 1,904 | 19,636 |
| G07 | 0 | C09 | Min | -37 | -10 | -10 | -74 | -1,040 | 9,430 |
| G07 | 138 | C09 | Min | -37 | -4 | -10 | -74 | -1,908 | 9,068 |
| G08 | 0 | C09 | Max | 27 | 131 | 9 | 412 | 1,904 | 19,567 |
| G08 | 146 | C09 | Max | 27 | 138 | 9 | 412 | 2,458 | 982 |
| G08 | 0 | C09 | Min | -27 | 58 | -9 | -414 | -1,908 | 9,137 |
| G08 | 146 | C09 | Min | -27 | 65 | -9 | -414 | -2,450 | -984 |
| G09 | 0 | C09 | Max | 68 | -25 | 7 | 73 | 1,960 | 468 |
| G09 | 146 | C09 | Max | 68 | -19 | 7 | 73 | 1,724 | 5,942 |
| G09 | 0 | C09 | Min | -68 | -43 | -7 | -76 | -1,968 | -463 |
| G09 | 146 | C09 | Min | -68 | -37 | -7 | -76 | -1,728 | 3,195 |
| G10 | 0 | C09 | Max | 61 | -20 | 6 | 73 | 1,724 | 5,942 |
| G10 | 138 | C09 | Max | 61 | -15 | 6 | 73 | 1,547 | 10,543 |
| G10 | 0 | C09 | Min | -61 | -36 | -6 | -76 | -1,728 | 3,195 |
| G10 | 138 | C09 | Min | -61 | -31 | -6 | -76 | -1,548 | 5,643 |
| G11 | 0 | C09 | Max | 53 | -16 | 5 | 73 | 1,547 | 10,543 |
| G11 | 174.5 | C09 | Max | 53 | -9 | 5 | 73 | 1,114 | 15,038 |
| G11 | 0 | C09 | Min | -53 | -30 | -5 | -76 | -1,548 | 5,643 |
| G11 | 174.5 | C09 | Min | -53 | -23 | -5 | -76 | -1,110 | 7,858 |
| G12 | 0 | C09 | Max | 47 | -9 | 6 | 73 | 1,114 | 15,038 |
| G12 | 36.5 | C09 | Max | 47 | -8 | 6 | 73 | 1,049 | 15,796 |
| G12 | 0 | C09 | Min | -47 | -22 | -6 | -76 | -1,110 | 7,858 |
| G12 | 36.5 | C09 | Min | -47 | -21 | -6 | -76 | -1,044 | 8,193 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C09 | Max | 42 | -8 | 7 | 73 | 1,049 | 15,796 |
| G13 | 129.5 | C09 | Max | 42 | -3 | 7 | 73 | 888 | 17,969 |
| G13 | 0 | C09 | Min | -42 | -20 | -7 | -76 | -1,044 | 8,193 |
| G13 | 129.5 | C09 | Min | -42 | -15 | -7 | -76 | -881 | 9,026 |
| G14 | 0 | C09 | Max | 36 | -3 | 7 | 73 | 888 | 17,969 |
| G14 | 81.5 | C09 | Max | 36 | 0 | 7 | 73 | 1,036 | 18,935 |
| G14 | 0 | C09 | Min | -36 | -15 | -7 | -76 | -881 | 9,026 |
| G14 | 81.5 | C09 | Min | -36 | -12 | -7 | -76 | -1,026 | 9,257 |
| G15 | 0 | C09 | Max | 32 | 0 | 9 | 73 | 1,036 | 18,935 |
| G15 | 138 | C09 | Max | 32 | 6 | 9 | 73 | 1,842 | 19,959 |
| G15 | 0 | C09 | Min | -32 | -12 | -9 | -76 | -1,026 | 9,257 |
| G15 | 138 | C09 | Min | -32 | -6 | -9 | -76 | -1,830 | 9,038 |
| G16 | 0 | C09 | Max | 25 | 132 | 9 | 436 | 1,842 | 19,866 |
| G16 | 146 | C09 | Max | 25 | 138 | 9 | 436 | 2,457 | 995 |
| G16 | 0 | C09 | Min | -25 | 61 | -9 | -433 | -1,830 | 9,131 |
| G16 | 146 | C09 | Min | -25 | 67 | -9 | -433 | -2,455 | -994 |
| | **Girders** | **C09** | **MAX:** | **80** | **138** | **10** | **436** | **2,458** | **19,959** |

**Case-09: Element Forces - Frames**

| Frame End Ties | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| ET1 | 0 | C09 | Max | 10 | -1 | 6 | 0 | 773 | -41 |
| ET1 | 120 | C09 | Max | 10 | 0 | 6 | 0 | 95 | 38 |
| ET1 | 0 | C09 | Min | -10 | -2 | -6 | 0 | -785 | -64 |
| ET1 | 120 | C09 | Min | -10 | 0 | -6 | 0 | -96 | 15 |
| ET2 | 0 | C09 | Max | 9 | 0 | 7 | 0 | 95 | 38 |
| ET2 | 120 | C09 | Max | 9 | 2 | 7 | 0 | 763 | -40 |
| ET2 | 0 | C09 | Min | -9 | 0 | -7 | 0 | -96 | 15 |
| ET2 | 120 | C09 | Min | -9 | 1 | -7 | 0 | -753 | -64 |
| ET3 | 0 | C09 | Max | 16 | -1 | 20 | 0 | 2,456 | -38 |
| ET3 | 120 | C09 | Max | 16 | 0 | 20 | 0 | 77 | 39 |
| ET3 | 0 | C09 | Min | 4 | -2 | -20 | 0 | -2,448 | -67 |
| ET3 | 120 | C09 | Min | 4 | 0 | -20 | 0 | -73 | 13 |
| ET4 | 0 | C09 | Max | 16 | 0 | 21 | 0 | 77 | 39 |
| ET4 | 120 | C09 | Max | 16 | 2 | 21 | 0 | 2,454 | -39 |
| ET4 | 0 | C09 | Min | 5 | 0 | -21 | 0 | -73 | 13 |
| ET4 | 120 | C09 | Min | 5 | 1 | -21 | 0 | -2,456 | -67 |
| | **End Ties** | **C09** | **MAX:** | **16** | **2** | **21** | **0** | **2,456** | **67** |

**Case-09: Element Forces - Frames**

| Frame Trucks | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| TK1 | 0 | C09 | Max | 20 | -10 | 52 | 874 | 0 | 351 |
| TK1 | 36 | C09 | Max | 20 | -9 | 52 | 874 | 1,869 | 897 |
| TK1 | 0 | C09 | Min | -20 | -30 | -52 | -875 | 0 | -350 |
| TK1 | 36 | C09 | Min | -20 | -28 | -52 | -875 | -1,872 | 473 |
| TK2 | 0 | C09 | Max | 1 | 29 | 46 | 786 | 1,671 | 1,089 |
| TK2 | 36 | C09 | Max | 1 | 31 | 46 | 786 | 0 | 0 |
| TK2 | 0 | C09 | Min | -1 | 10 | -46 | -789 | -1,666 | 383 |
| TK2 | 36 | C09 | Min | -1 | 12 | -46 | -789 | 0 | 0 |
| TK3 | 0 | C09 | Max | 1 | -13 | 41 | 688 | 0 | 0 |
| TK3 | 36 | C09 | Max | 1 | -11 | 41 | 688 | 1,449 | 965 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C09 | Min | -1 | -28 | -40 | -693 | 0 | 0 |
| TK3 | 36 | C09 | Min | -1 | -26 | -40 | -693 | -1,459 | 437 |
| TK4 | 0 | C09 | Max | 1 | 24 | 47 | 789 | 1,686 | 909 |
| TK4 | 36 | C09 | Max | 1 | 26 | 47 | 789 | 0 | 0 |
| TK4 | 0 | C09 | Min | -1 | 10 | -47 | -793 | -1,679 | 390 |
| TK4 | 36 | C09 | Min | -1 | 12 | -47 | -793 | 0 | 0 |
| TK5 | 0 | C09 | Max | 15 | -58 | 2 | 1 | 0 | 259 |
| TK5 | 36 | C09 | Max | 15 | -56 | 2 | 1 | 60 | 4,860 |
| TK5 | 0 | C09 | Min | -15 | -139 | -2 | -1 | 0 | -259 |
| TK5 | 36 | C09 | Min | -15 | -137 | -2 | -1 | -60 | 2,132 |
| TK6 | 0 | C09 | Max | 1 | 136 | 2 | 0 | 60 | 4,928 |
| TK6 | 36 | C09 | Max | 1 | 138 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C09 | Min | -1 | 54 | -2 | 0 | -60 | 1,983 |
| TK6 | 36 | C09 | Min | -1 | 56 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C09 | Max | 1 | -59 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C09 | Max | 1 | -57 | 2 | 0 | 59 | 4,717 |
| TK7 | 0 | C09 | Min | -1 | -132 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C09 | Min | -1 | -130 | -2 | 0 | -59 | 2,084 |
| TK8 | 0 | C09 | Max | 1 | 133 | 2 | 0 | 57 | 4,833 |
| TK8 | 36 | C09 | Max | 1 | 135 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C09 | Min | -1 | 56 | -2 | 0 | -57 | 2,049 |
| TK8 | 36 | C09 | Min | -1 | 58 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C09** | **MAX:** | **20** | **139** | **52** | **875** | **1,872** | **4,928** |

## D.10 Case-10

| Case-10: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C10 | Max | 77 | -46 | 10 | 511 | 2,455 | 481 |
| G01 | 146 | C10 | Max | 77 | -40 | 10 | 511 | 1,046 | 9,352 |
| G01 | 0 | C10 | Min | -77 | -67 | -10 | -509 | -2,444 | -490 |
| G01 | 146 | C10 | Min | -77 | -61 | -10 | -509 | -1,040 | 6,243 |
| G02 | 0 | C10 | Max | 68 | -41 | 12 | 511 | 1,046 | 9,352 |
| G02 | 138 | C10 | Max | 68 | -35 | 12 | 511 | 634 | 17,022 |
| G02 | 0 | C10 | Min | -68 | -59 | -12 | -509 | -1,040 | 6,243 |
| G02 | 138 | C10 | Min | -68 | -53 | -12 | -509 | -633 | 11,540 |
| G03 | 0 | C10 | Max | 58 | -35 | 11 | 511 | 634 | 17,022 |
| G03 | 174.5 | C10 | Max | 58 | -27 | 11 | 511 | 2,463 | 25,271 |
| G03 | 0 | C10 | Min | -58 | -52 | -11 | -509 | -633 | 11,540 |
| G03 | 174.5 | C10 | Min | -58 | -45 | -11 | -509 | -2,468 | 17,209 |
| G04 | 0 | C10 | Max | 49 | 13 | 2 | 153 | 2,463 | 25,230 |
| G04 | 36.5 | C10 | Max | 49 | 14 | 2 | 153 | 2,433 | 24,791 |
| G04 | 0 | C10 | Min | -49 | 5 | -2 | -158 | -2,468 | 17,250 |
| G04 | 36.5 | C10 | Min | -49 | 7 | -2 | -158 | -2,436 | 16,981 |
| G05 | 0 | C10 | Max | 44 | 15 | 3 | 153 | 2,433 | 24,791 |
| G05 | 109.5 | C10 | Max | 44 | 20 | 3 | 153 | 2,214 | 23,094 |
| G05 | 0 | C10 | Min | -44 | 6 | -3 | -158 | -2,436 | 16,981 |
| G05 | 109.5 | C10 | Min | -44 | 11 | -3 | -158 | -2,208 | 15,826 |
| G06 | 0 | C10 | Max | 38 | 51 | 11 | 570 | 2,214 | 23,094 |
| G06 | 101.5 | C10 | Max | 38 | 56 | 11 | 570 | 1,159 | 17,764 |
| G06 | 0 | C10 | Min | -38 | 32 | -11 | -570 | -2,208 | 15,826 |
| G06 | 101.5 | C10 | Min | -38 | 37 | -11 | -570 | -1,152 | 12,219 |
| G07 | 0 | C10 | Max | 31 | 56 | 11 | 570 | 1,159 | 17,764 |
| G07 | 138 | C10 | Max | 31 | 62 | 11 | 570 | 581 | 9,744 |
| G07 | 0 | C10 | Min | -31 | 37 | -11 | -570 | -1,152 | 12,219 |
| G07 | 138 | C10 | Min | -31 | 43 | -11 | -570 | -574 | 6,585 |
| G08 | 0 | C10 | Max | 23 | 63 | 10 | 570 | 581 | 9,744 |
| G08 | 146 | C10 | Max | 23 | 70 | 10 | 570 | 1,870 | 782 |
| G08 | 0 | C10 | Min | -23 | 42 | -10 | -570 | -574 | 6,585 |
| G08 | 146 | C10 | Min | -23 | 48 | -10 | -570 | -1,863 | -785 |
| G09 | 0 | C10 | Max | 69 | -45 | 10 | 504 | 2,442 | 552 |
| G09 | 146 | C10 | Max | 69 | -39 | 10 | 504 | 1,041 | 8,986 |
| G09 | 0 | C10 | Min | -69 | -64 | -10 | -506 | -2,445 | -544 |
| G09 | 146 | C10 | Min | -69 | -58 | -10 | -506 | -1,038 | 6,036 |
| G10 | 0 | C10 | Max | 60 | -40 | 11 | 504 | 1,041 | 8,986 |
| G10 | 138 | C10 | Max | 60 | -34 | 11 | 504 | 614 | 16,460 |
| G10 | 0 | C10 | Min | -61 | -57 | -11 | -506 | -1,038 | 6,036 |
| G10 | 138 | C10 | Min | -61 | -51 | -11 | -506 | -606 | 11,171 |
| G11 | 0 | C10 | Max | 51 | -35 | 11 | 504 | 614 | 16,460 |
| G11 | 174.5 | C10 | Max | 51 | -28 | 11 | 504 | 2,476 | 24,546 |
| G11 | 0 | C10 | Min | -51 | -51 | -11 | -506 | -606 | 11,171 |
| G11 | 174.5 | C10 | Min | -51 | -44 | -11 | -506 | -2,461 | 16,824 |
| G12 | 0 | C10 | Max | 43 | 13 | 2 | 141 | 2,476 | 24,552 |
| G12 | 36.5 | C10 | Max | 43 | 15 | 2 | 141 | 2,429 | 24,087 |
| G12 | 0 | C10 | Min | -43 | 6 | -2 | -137 | -2,461 | 16,818 |
| G12 | 36.5 | C10 | Min | -43 | 8 | -2 | -137 | -2,416 | 16,518 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C10 | Max | 39 | 15 | 3 | 141 | 2,429 | 24,087 |
| G13 | 109.5 | C10 | Max | 39 | 20 | 3 | 141 | 2,189 | 22,334 |
| G13 | 0 | C10 | Min | -39 | 7 | -3 | -137 | -2,416 | 16,518 |
| G13 | 109.5 | C10 | Min | -39 | 12 | -3 | -137 | -2,184 | 15,327 |
| G14 | 0 | C10 | Max | 34 | 49 | 11 | 558 | 2,189 | 22,334 |
| G14 | 101.5 | C10 | Max | 34 | 53 | 11 | 558 | 1,134 | 17,145 |
| G14 | 0 | C10 | Min | -34 | 33 | -11 | -558 | -2,184 | 15,327 |
| G14 | 101.5 | C10 | Min | -34 | 37 | -11 | -558 | -1,129 | 11,765 |
| G15 | 0 | C10 | Max | 28 | 54 | 11 | 558 | 1,134 | 17,145 |
| G15 | 138 | C10 | Max | 28 | 60 | 11 | 558 | 513 | 9,366 |
| G15 | 0 | C10 | Min | -28 | 36 | -11 | -558 | -1,129 | 11,765 |
| G15 | 138 | C10 | Min | -28 | 42 | -11 | -558 | -508 | 6,312 |
| G16 | 0 | C10 | Max | 21 | 61 | 10 | 558 | 513 | 9,366 |
| G16 | 146 | C10 | Max | 21 | 67 | 10 | 558 | 1,858 | 742 |
| G16 | 0 | C10 | Min | -21 | 41 | -10 | -558 | -508 | 6,312 |
| G16 | 146 | C10 | Min | -21 | 47 | -10 | -558 | -1,853 | -740 |
| | **Girders** | **C10** | **MAX:** | **77** | **70** | **12** | **570** | **2,476** | **25,271** |

**Case-10: Element Forces - Frames**

| Frame End Ties | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| ET1 | 0 | C10 | Max | 9 | -1 | 9 | 0 | 1,052 | -40 |
| ET1 | 120 | C10 | Max | 9 | 0 | 9 | 0 | 72 | 37 |
| ET1 | 0 | C10 | Min | -9 | -1 | -9 | 0 | -1,074 | -64 |
| ET1 | 120 | C10 | Min | -9 | 0 | -9 | 0 | -73 | 16 |
| ET2 | 0 | C10 | Max | 8 | 0 | 9 | 0 | 72 | 37 |
| ET2 | 120 | C10 | Max | 8 | 1 | 9 | 0 | 1,073 | -41 |
| ET2 | 0 | C10 | Min | -8 | 0 | -9 | 0 | -73 | 16 |
| ET2 | 120 | C10 | Min | -8 | 1 | -9 | 0 | -1,054 | -64 |
| ET3 | 0 | C10 | Max | 14 | -1 | 16 | 0 | 1,874 | -42 |
| ET3 | 120 | C10 | Max | 14 | 0 | 16 | 0 | 102 | 36 |
| ET3 | 0 | C10 | Min | -14 | -1 | -16 | 0 | -1,867 | -63 |
| ET3 | 120 | C10 | Min | -14 | 0 | -16 | 0 | -101 | 16 |
| ET4 | 0 | C10 | Max | 12 | 0 | 16 | 0 | 102 | 36 |
| ET4 | 120 | C10 | Max | 12 | 1 | 16 | 0 | 1,857 | -41 |
| ET4 | 0 | C10 | Min | -12 | 0 | -16 | 0 | -101 | 16 |
| ET4 | 120 | C10 | Min | -12 | 1 | -16 | 0 | -1,862 | -64 |
| | **End Ties** | **C10** | **MAX:** | **14** | **1** | **16** | **0** | **1,874** | **64** |

**Case-10: Element Forces - Frames**

| Frame Trucks | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| TK1 | 0 | C10 | Max | 17 | -18 | 42 | 710 | 0 | 290 |
| TK1 | 36 | C10 | Max | 17 | -16 | 42 | 710 | 1,501 | 1,354 |
| TK1 | 0 | C10 | Min | -17 | -43 | -42 | -712 | 0 | -290 |
| TK1 | 36 | C10 | Min | -17 | -41 | -42 | -712 | -1,504 | 756 |
| TK2 | 0 | C10 | Max | 1 | 41 | 50 | 839 | 1,793 | 1,528 |
| TK2 | 36 | C10 | Max | 1 | 43 | 50 | 839 | 0 | 0 |
| TK2 | 0 | C10 | Min | -1 | 18 | -50 | -843 | -1,785 | 685 |
| TK2 | 36 | C10 | Min | -1 | 20 | -50 | -843 | 0 | 0 |
| TK3 | 0 | C10 | Max | 1 | -21 | 44 | 740 | 0 | 0 |
| TK3 | 36 | C10 | Max | 1 | -19 | 44 | 740 | 1,571 | 1,391 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C10 | Min | -1 | -40 | -44 | -747 | 0 | 0 |
| TK3 | 36 | C10 | Min | -1 | -38 | -44 | -747 | -1,585 | 737 |
| TK4 | 0 | C10 | Max | 1 | 36 | 43 | 728 | 1,541 | 1,318 |
| TK4 | 36 | C10 | Max | 1 | 38 | 43 | 728 | 0 | 0 |
| TK4 | 0 | C10 | Min | -1 | 19 | -43 | -732 | -1,531 | 705 |
| TK4 | 36 | C10 | Min | -1 | 21 | -43 | -732 | 0 | 0 |
| TK5 | 0 | C10 | Max | 26 | -17 | 2 | 1 | 0 | 446 |
| TK5 | 36 | C10 | Max | 26 | -16 | 2 | 1 | 59 | 1,446 |
| TK5 | 0 | C10 | Min | -26 | -46 | -2 | -1 | 0 | -446 |
| TK5 | 36 | C10 | Min | -26 | -44 | -2 | -1 | -59 | 753 |
| TK6 | 0 | C10 | Max | 1 | 44 | 2 | 0 | 58 | 1,608 |
| TK6 | 36 | C10 | Max | 1 | 46 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C10 | Min | -1 | 18 | -2 | 0 | -58 | 695 |
| TK6 | 36 | C10 | Min | -1 | 20 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C10 | Max | 1 | -22 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C10 | Max | 1 | -20 | 2 | 0 | 62 | 1,465 |
| TK7 | 0 | C10 | Min | -1 | -42 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C10 | Min | -1 | -40 | -2 | 0 | -62 | 744 |
| TK8 | 0 | C10 | Max | 1 | 38 | 2 | 0 | 58 | 1,406 |
| TK8 | 36 | C10 | Max | 1 | 40 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C10 | Min | -1 | 18 | -2 | 0 | -58 | 699 |
| TK8 | 36 | C10 | Min | -1 | 20 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C10** | **MAX:** | **26** | **46** | **50** | **843** | **1,793** | **1,608** |

## D.11 Case-11

| Case-11: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C11 | Max | 80 | -30 | 7 | 137 | 2,522 | 544 |
| G01 | 146 | C11 | Max | 80 | -23 | 7 | 137 | 2,029 | 6,423 |
| G01 | 0 | C11 | Min | -80 | -48 | -7 | -136 | -2,516 | -549 |
| G01 | 146 | C11 | Min | -80 | -41 | -7 | -136 | -2,025 | 3,924 |
| G02 | 0 | C11 | Max | 72 | -26 | 7 | 137 | 2,029 | 6,423 |
| G02 | 138 | C11 | Max | 72 | -20 | 7 | 137 | 1,657 | 11,171 |
| G02 | 0 | C11 | Min | -72 | -38 | -7 | -136 | -2,025 | 3,924 |
| G02 | 138 | C11 | Min | -72 | -32 | -7 | -136 | -1,655 | 7,179 |
| G03 | 0 | C11 | Max | 62 | -20 | 7 | 137 | 1,657 | 11,171 |
| G03 | 174.5 | C11 | Max | 62 | -12 | 7 | 137 | 1,263 | 15,618 |
| G03 | 0 | C11 | Min | -62 | -32 | -7 | -136 | -1,655 | 7,179 |
| G03 | 174.5 | C11 | Min | -62 | -24 | -7 | -136 | -1,263 | 10,373 |
| G04 | 0 | C11 | Max | 56 | -13 | 7 | 137 | 1,263 | 15,618 |
| G04 | 36.5 | C11 | Max | 56 | -11 | 7 | 137 | 1,213 | 16,342 |
| G04 | 0 | C11 | Min | -56 | -23 | -7 | -136 | -1,263 | 10,373 |
| G04 | 36.5 | C11 | Min | -56 | -22 | -7 | -136 | -1,213 | 10,898 |
| G05 | 0 | C11 | Max | 50 | -11 | 8 | 137 | 1,213 | 16,342 |
| G05 | 138 | C11 | Max | 50 | -5 | 8 | 137 | 1,264 | 18,641 |
| G05 | 0 | C11 | Min | -50 | -22 | -8 | -136 | -1,213 | 10,898 |
| G05 | 138 | C11 | Min | -50 | -15 | -8 | -136 | -1,266 | 12,224 |
| G06 | 0 | C11 | Max | 43 | -5 | 9 | 137 | 1,264 | 18,641 |
| G06 | 73 | C11 | Max | 43 | -2 | 9 | 137 | 1,549 | 19,498 |
| G06 | 0 | C11 | Min | -43 | -15 | -9 | -136 | -1,266 | 12,224 |
| G06 | 73 | C11 | Min | -43 | -12 | -9 | -136 | -1,552 | 12,584 |
| G07 | 0 | C11 | Max | 35 | 46 | 9 | 334 | 1,549 | 19,336 |
| G07 | 146 | C11 | Max | 35 | 53 | 9 | 334 | 1,910 | 12,327 |
| G07 | 0 | C11 | Min | -35 | 27 | -9 | -334 | -1,552 | 12,746 |
| G07 | 146 | C11 | Min | -35 | 34 | -9 | -334 | -1,913 | 8,121 |
| G08 | 0 | C11 | Max | 28 | 86 | 11 | 453 | 1,910 | 12,327 |
| G08 | 138 | C11 | Max | 28 | 92 | 11 | 453 | 2,549 | 1,027 |
| G08 | 0 | C11 | Min | -28 | 56 | -11 | -457 | -1,913 | 8,121 |
| G08 | 138 | C11 | Min | -28 | 63 | -11 | -457 | -2,540 | -1,029 |
| G09 | 0 | C11 | Max | 67 | -30 | 7 | 152 | 2,545 | 549 |
| G09 | 146 | C11 | Max | 67 | -24 | 7 | 152 | 2,005 | 6,102 |
| G09 | 0 | C11 | Min | -67 | -44 | -7 | -153 | -2,548 | -544 |
| G09 | 146 | C11 | Min | -67 | -38 | -7 | -153 | -2,005 | 3,803 |
| G10 | 0 | C11 | Max | 60 | -25 | 7 | 152 | 2,005 | 6,102 |
| G10 | 138 | C11 | Max | 60 | -19 | 7 | 152 | 1,665 | 10,647 |
| G10 | 0 | C11 | Min | -60 | -37 | -7 | -153 | -2,005 | 3,803 |
| G10 | 138 | C11 | Min | -60 | -31 | -7 | -153 | -1,662 | 7,031 |
| G11 | 0 | C11 | Max | 52 | -20 | 7 | 152 | 1,665 | 10,647 |
| G11 | 174.5 | C11 | Max | 52 | -13 | 7 | 152 | 1,199 | 15,256 |
| G11 | 0 | C11 | Min | -53 | -31 | -7 | -153 | -1,662 | 7,031 |
| G11 | 174.5 | C11 | Min | -53 | -24 | -7 | -153 | -1,194 | 10,050 |
| G12 | 0 | C11 | Max | 47 | -13 | 8 | 152 | 1,199 | 15,256 |
| G12 | 36.5 | C11 | Max | 47 | -12 | 8 | 152 | 1,151 | 16,047 |
| G12 | 0 | C11 | Min | -47 | -23 | -8 | -153 | -1,194 | 10,050 |
| G12 | 36.5 | C11 | Min | -47 | -22 | -8 | -153 | -1,144 | 10,542 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C11 | Max | 42 | -12 | 9 | 152 | 1,151 | 16,047 |
| G13 | 138 | C11 | Max | 42 | -6 | 9 | 152 | 1,297 | 18,518 |
| G13 | 0 | C11 | Min | -42 | -22 | -9 | -153 | -1,144 | 10,542 |
| G13 | 138 | C11 | Min | -42 | -16 | -9 | -153 | -1,289 | 11,954 |
| G14 | 0 | C11 | Max | 37 | -7 | 9 | 152 | 1,297 | 18,518 |
| G14 | 73 | C11 | Max | 37 | -4 | 9 | 152 | 1,644 | 19,460 |
| G14 | 0 | C11 | Min | -37 | -16 | -9 | -153 | -1,289 | 11,954 |
| G14 | 73 | C11 | Min | -37 | -13 | -9 | -153 | -1,635 | 12,442 |
| G15 | 0 | C11 | Max | 28 | 48 | 9 | 390 | 1,644 | 19,226 |
| G15 | 146 | C11 | Max | 28 | 54 | 9 | 390 | 1,903 | 12,060 |
| G15 | 0 | C11 | Min | -28 | 30 | -9 | -391 | -1,635 | 12,676 |
| G15 | 146 | C11 | Min | -28 | 36 | -9 | -391 | -1,892 | 7,637 |
| G16 | 0 | C11 | Max | 24 | 84 | 11 | 471 | 1,903 | 12,060 |
| G16 | 138 | C11 | Max | 24 | 89 | 11 | 471 | 2,538 | 1,020 |
| G16 | 0 | C11 | Min | -24 | 54 | -11 | -467 | -1,892 | 7,637 |
| G16 | 138 | C11 | Min | -24 | 59 | -11 | -467 | -2,539 | -1,019 |
| | **Girders** | **C11** | **MAX:** | **80** | **92** | **11** | **471** | **2,549** | **19,498** |

**Case-11: Element Forces - Frames**

| Frame End Ties | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| ET1 | 0 | C11 | Max | 13 | -1 | 8 | 0 | 964 | -30 |
| ET1 | 120 | C11 | Max | 13 | 0 | 8 | 0 | 86 | 49 |
| ET1 | 0 | C11 | Min | -13 | -2 | -8 | 0 | -978 | -74 |
| ET1 | 120 | C11 | Min | -13 | 0 | -8 | 0 | -87 | 4 |
| ET2 | 0 | C11 | Max | 11 | 0 | 8 | 0 | 86 | 49 |
| ET2 | 120 | C11 | Max | 11 | 2 | 8 | 0 | 981 | -30 |
| ET2 | 0 | C11 | Min | -11 | 0 | -8 | 0 | -87 | 4 |
| ET2 | 120 | C11 | Min | -11 | 1 | -8 | 0 | -969 | -74 |
| ET3 | 0 | C11 | Max | 11 | -1 | 21 | 0 | 2,552 | -30 |
| ET3 | 120 | C11 | Max | 11 | 0 | 21 | 0 | 88 | 47 |
| ET3 | 0 | C11 | Min | -11 | -2 | -21 | 0 | -2,543 | -74 |
| ET3 | 120 | C11 | Min | -11 | 0 | -21 | 0 | -83 | 5 |
| ET4 | 0 | C11 | Max | 10 | 0 | 21 | 0 | 88 | 47 |
| ET4 | 120 | C11 | Max | 10 | 2 | 21 | 0 | 2,543 | -31 |
| ET4 | 0 | C11 | Min | -10 | 0 | -21 | 0 | -83 | 5 |
| ET4 | 120 | C11 | Min | -10 | 1 | -21 | 0 | -2,543 | -74 |
| | **End Ties** | **C11** | **MAX:** | **13** | **2** | **21** | **0** | **2,552** | **74** |

**Case-11: Element Forces - Frames**

| Frame Trucks | Station in | Output Case | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
|---|---|---|---|---|---|---|---|---|---|
| TK1 | 0 | C11 | Max | 23 | -8 | 54 | 906 | 0 | 398 |
| TK1 | 36 | C11 | Max | 23 | -6 | 54 | 906 | 1,946 | 970 |
| TK1 | 0 | C11 | Min | -23 | -35 | -54 | -907 | 0 | -397 |
| TK1 | 36 | C11 | Min | -23 | -33 | -54 | -907 | -1,948 | 492 |
| TK2 | 0 | C11 | Max | 1 | 33 | 47 | 800 | 1,707 | 1,233 |
| TK2 | 36 | C11 | Max | 1 | 35 | 47 | 800 | 0 | 0 |
| TK2 | 0 | C11 | Min | -1 | 8 | -47 | -802 | -1,702 | 333 |
| TK2 | 36 | C11 | Min | -1 | 10 | -47 | -802 | 0 | 0 |
| TK3 | 0 | C11 | Max | 1 | -12 | 42 | 709 | 0 | 0 |
| TK3 | 36 | C11 | Max | 1 | -10 | 42 | 709 | 1,503 | 1,109 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C11 | Min | -1 | -32 | -42 | -713 | 0 | 0 |
| TK3 | 36 | C11 | Min | -1 | -30 | -42 | -713 | -1,512 | 388 |
| TK4 | 0 | C11 | Max | 1 | 27 | 48 | 814 | 1,737 | 1,001 |
| TK4 | 36 | C11 | Max | 1 | 29 | 48 | 814 | 0 | 0 |
| TK4 | 0 | C11 | Min | -1 | 10 | -48 | -816 | -1,731 | 391 |
| TK4 | 36 | C11 | Min | -1 | 12 | -48 | -816 | 0 | 0 |
| TK5 | 0 | C11 | Max | 22 | -24 | 2 | 1 | 0 | 370 |
| TK5 | 36 | C11 | Max | 22 | -22 | 2 | 1 | 64 | 1,766 |
| TK5 | 0 | C11 | Min | -22 | -57 | -2 | -1 | 0 | -370 |
| TK5 | 36 | C11 | Min | -22 | -55 | -2 | -1 | -64 | 1,080 |
| TK6 | 0 | C11 | Max | 1 | 53 | 2 | 0 | 64 | 1,956 |
| TK6 | 36 | C11 | Max | 1 | 55 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C11 | Min | -1 | 27 | -2 | 0 | -64 | 994 |
| TK6 | 36 | C11 | Min | -1 | 29 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C11 | Max | 1 | -32 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C11 | Max | 1 | -30 | 2 | 0 | 59 | 1,739 |
| TK7 | 0 | C11 | Min | -1 | -49 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C11 | Min | -1 | -47 | -2 | 0 | -59 | 1,101 |
| TK8 | 0 | C11 | Max | 1 | 47 | 2 | 0 | 59 | 1,719 |
| TK8 | 36 | C11 | Max | 1 | 49 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C11 | Min | -1 | 27 | -2 | 0 | -59 | 1,017 |
| TK8 | 36 | C11 | Min | -1 | 29 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C11** | **MAX:** | **23** | **57** | **54** | **907** | **1,948** | **1,956** |

## D.12 Case-12

| Case-12: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C12 | Max | 80 | -23 | 7 | 76 | 2,156 | 457 |
| G01 | 146 | C12 | Max | 80 | -16 | 7 | 76 | 1,775 | 4,695 |
| G01 | 0 | C12 | Min | -80 | -35 | -7 | -75 | -2,151 | -462 |
| G01 | 146 | C12 | Min | -80 | -28 | -7 | -75 | -1,772 | 2,769 |
| G02 | 0 | C12 | Max | 71 | -18 | 6 | 76 | 1,775 | 4,695 |
| G02 | 138 | C12 | Max | 71 | -12 | 6 | 76 | 1,671 | 7,778 |
| G02 | 0 | C12 | Min | -71 | -27 | -6 | -75 | -1,772 | 2,769 |
| G02 | 138 | C12 | Min | -71 | -20 | -6 | -75 | -1,669 | 4,964 |
| G03 | 0 | C12 | Max | 61 | -13 | 5 | 76 | 1,671 | 7,778 |
| G03 | 174.5 | C12 | Max | 61 | -5 | 5 | 76 | 1,185 | 10,201 |
| G03 | 0 | C12 | Min | -61 | -19 | -5 | -75 | -1,669 | 4,964 |
| G03 | 174.5 | C12 | Min | -61 | -11 | -5 | -75 | -1,185 | 6,736 |
| G04 | 0 | C12 | Max | 55 | -5 | 6 | 76 | 1,185 | 10,201 |
| G04 | 36.5 | C12 | Max | 55 | -3 | 6 | 76 | 1,114 | 10,510 |
| G04 | 0 | C12 | Min | -54 | -11 | -6 | -75 | -1,185 | 6,736 |
| G04 | 36.5 | C12 | Min | -54 | -9 | -6 | -75 | -1,114 | 6,955 |
| G05 | 0 | C12 | Max | 50 | -3 | 8 | 76 | 1,114 | 10,510 |
| G05 | 129.5 | C12 | Max | 50 | 3 | 8 | 76 | 856 | 11,024 |
| G05 | 0 | C12 | Min | -50 | -10 | -8 | -75 | -1,114 | 6,955 |
| G05 | 129.5 | C12 | Min | -50 | -4 | -8 | -75 | -858 | 7,335 |
| G06 | 0 | C12 | Max | 43 | 3 | 8 | 76 | 856 | 11,024 |
| G06 | 81.5 | C12 | Max | 43 | 6 | 8 | 76 | 1,049 | 10,956 |
| G06 | 0 | C12 | Min | -43 | -4 | -8 | -75 | -858 | 7,335 |
| G06 | 81.5 | C12 | Min | -43 | 0 | -8 | -75 | -1,051 | 7,185 |
| G07 | 0 | C12 | Max | 37 | 7 | 10 | 76 | 1,049 | 10,956 |
| G07 | 138 | C12 | Max | 37 | 13 | 10 | 76 | 1,957 | 10,078 |
| G07 | 0 | C12 | Min | -37 | -1 | -10 | -75 | -1,051 | 7,185 |
| G07 | 138 | C12 | Min | -37 | 6 | -10 | -75 | -1,961 | 6,315 |
| G08 | 0 | C12 | Max | 27 | 64 | 9 | 404 | 1,957 | 9,823 |
| G08 | 146 | C12 | Max | 27 | 70 | 9 | 404 | 2,531 | 1,016 |
| G08 | 0 | C12 | Min | -27 | 42 | -9 | -407 | -1,961 | 6,569 |
| G08 | 146 | C12 | Min | -27 | 49 | -9 | -407 | -2,524 | -1,018 |
| G09 | 0 | C12 | Max | 68 | -22 | 6 | 72 | 2,066 | 465 |
| G09 | 146 | C12 | Max | 68 | -16 | 6 | 72 | 1,753 | 4,259 |
| G09 | 0 | C12 | Min | -68 | -32 | -6 | -73 | -2,069 | -460 |
| G09 | 146 | C12 | Min | -68 | -26 | -6 | -73 | -1,754 | 2,749 |
| G10 | 0 | C12 | Max | 60 | -17 | 6 | 72 | 1,753 | 4,259 |
| G10 | 138 | C12 | Max | 60 | -11 | 6 | 72 | 1,587 | 7,269 |
| G10 | 0 | C12 | Min | -60 | -25 | -6 | -73 | -1,754 | 2,749 |
| G10 | 138 | C12 | Min | -60 | -20 | -6 | -73 | -1,586 | 4,775 |
| G11 | 0 | C12 | Max | 52 | -12 | 5 | 72 | 1,587 | 7,269 |
| G11 | 174.5 | C12 | Max | 52 | -5 | 5 | 72 | 1,100 | 9,819 |
| G11 | 0 | C12 | Min | -52 | -19 | -5 | -73 | -1,586 | 4,775 |
| G11 | 174.5 | C12 | Min | -52 | -11 | -5 | -73 | -1,097 | 6,390 |
| G12 | 0 | C12 | Max | 46 | -6 | 6 | 72 | 1,100 | 9,819 |
| G12 | 36.5 | C12 | Max | 46 | -5 | 6 | 72 | 1,039 | 10,162 |
| G12 | 0 | C12 | Min | -46 | -11 | -6 | -73 | -1,097 | 6,390 |
| G12 | 36.5 | C12 | Min | -46 | -9 | -6 | -73 | -1,035 | 6,607 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C12 | Max | 42 | -5 | 7 | 72 | 1,039 | 10,162 |
| G13 | 129.5 | C12 | Max | 42 | 0 | 7 | 72 | 846 | 10,815 |
| G13 | 0 | C12 | Min | -42 | -9 | -7 | -73 | -1,035 | 6,607 |
| G13 | 129.5 | C12 | Min | -42 | -3 | -7 | -73 | -840 | 7,072 |
| G14 | 0 | C12 | Max | 36 | 1 | 7 | 72 | 846 | 10,815 |
| G14 | 81.5 | C12 | Max | 36 | 4 | 7 | 72 | 1,032 | 10,778 |
| G14 | 0 | C12 | Min | -36 | -4 | -7 | -73 | -840 | 7,072 |
| G14 | 81.5 | C12 | Min | -36 | -1 | -7 | -73 | -1,024 | 7,117 |
| G15 | 0 | C12 | Max | 32 | 6 | 8 | 72 | 1,032 | 10,778 |
| G15 | 138 | C12 | Max | 32 | 11 | 8 | 72 | 1,865 | 10,095 |
| G15 | 0 | C12 | Min | -32 | -3 | -9 | -73 | -1,024 | 7,117 |
| G15 | 138 | C12 | Min | -32 | 3 | -9 | -73 | -1,856 | 6,591 |
| G16 | 0 | C12 | Max | 24 | 66 | 9 | 432 | 1,865 | 9,918 |
| G16 | 146 | C12 | Max | 24 | 72 | 9 | 432 | 2,520 | 999 |
| G16 | 0 | C12 | Min | -24 | 42 | -9 | -429 | -1,856 | 6,769 |
| G16 | 146 | C12 | Min | -24 | 48 | -9 | -429 | -2,520 | -998 |
| | **Girders** | **C12** | **MAX:** | **80** | **72** | **10** | **432** | **2,531** | **11,024** |

**Case-12: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **End Ties** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| ET1 | 0 | C12 | Max | 11 | -1 | 7 | 0 | 799 | -41 |
| ET1 | 120 | C12 | Max | 11 | 0 | 7 | 0 | 89 | 38 |
| ET1 | 0 | C12 | Min | -11 | -2 | -7 | 0 | -812 | -64 |
| ET1 | 120 | C12 | Min | -11 | 0 | -7 | 0 | -90 | 15 |
| ET2 | 0 | C12 | Max | 10 | 0 | 7 | 0 | 89 | 38 |
| ET2 | 120 | C12 | Max | 10 | 2 | 7 | 0 | 787 | -41 |
| ET2 | 0 | C12 | Min | -10 | 0 | -7 | 0 | -90 | 15 |
| ET2 | 120 | C12 | Min | -10 | 1 | -7 | 0 | -775 | -64 |
| ET3 | 0 | C12 | Max | 6 | -1 | 21 | 0 | 2,533 | -38 |
| ET3 | 120 | C12 | Max | 6 | 0 | 21 | 0 | 78 | 39 |
| ET3 | 0 | C12 | Min | 0 | -2 | -21 | 0 | -2,526 | -67 |
| ET3 | 120 | C12 | Min | 0 | 0 | -21 | 0 | -74 | 14 |
| ET4 | 0 | C12 | Max | 6 | 0 | 21 | 0 | 78 | 39 |
| ET4 | 120 | C12 | Max | 6 | 2 | 21 | 0 | 2,523 | -40 |
| ET4 | 0 | C12 | Min | 0 | 0 | -21 | 0 | -74 | 14 |
| ET4 | 120 | C12 | Min | 0 | 1 | -21 | 0 | -2,523 | -65 |
| | **End Ties** | **C12** | **MAX:** | **11** | **2** | **21** | **0** | **2,533** | **67** |

**Case-12: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **Trucks** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| TK1 | 0 | C12 | Max | 20 | -7 | 53 | 893 | 0 | 342 |
| TK1 | 36 | C12 | Max | 20 | -5 | 53 | 893 | 1,900 | 716 |
| TK1 | 0 | C12 | Min | -20 | -26 | -53 | -894 | 0 | -342 |
| TK1 | 36 | C12 | Min | -20 | -24 | -53 | -894 | -1,903 | 391 |
| TK2 | 0 | C12 | Max | 1 | 26 | 45 | 769 | 1,633 | 989 |
| TK2 | 36 | C12 | Max | 1 | 28 | 45 | 769 | 0 | 0 |
| TK2 | 0 | C12 | Min | -1 | 5 | -45 | -771 | -1,627 | 221 |
| TK2 | 36 | C12 | Min | -1 | 7 | -45 | -771 | 0 | 0 |
| TK3 | 0 | C12 | Max | 1 | -9 | 41 | 688 | 0 | 0 |
| TK3 | 36 | C12 | Max | 1 | -7 | 41 | 688 | 1,456 | 837 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C12 | Min | -1 | -24 | -40 | -692 | 0 | 0 |
| TK3 | 36 | C12 | Min | -1 | -22 | -40 | -692 | -1,465 | 303 |
| TK4 | 0 | C12 | Max | 1 | 19 | 46 | 777 | 1,666 | 736 |
| TK4 | 36 | C12 | Max | 1 | 21 | 46 | 777 | 0 | 0 |
| TK4 | 0 | C12 | Min | -1 | 7 | -46 | -779 | -1,660 | 300 |
| TK4 | 36 | C12 | Min | -1 | 9 | -46 | -779 | 0 | 0 |
| TK5 | 0 | C12 | Max | 18 | -29 | 2 | 1 | 0 | 300 |
| TK5 | 36 | C12 | Max | 18 | -27 | 2 | 1 | 59 | 2,021 |
| TK5 | 0 | C12 | Min | -18 | -62 | -2 | -1 | 0 | -300 |
| TK5 | 36 | C12 | Min | -18 | -60 | -2 | -1 | -59 | 1,208 |
| TK6 | 0 | C12 | Max | 1 | 60 | 2 | 0 | 58 | 2,182 |
| TK6 | 36 | C12 | Max | 1 | 62 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C12 | Min | -1 | 29 | -2 | 0 | -58 | 1,096 |
| TK6 | 36 | C12 | Min | -1 | 31 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C12 | Max | 1 | -35 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C12 | Max | 1 | -33 | 2 | 0 | 58 | 1,940 |
| TK7 | 0 | C12 | Min | -1 | -55 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C12 | Min | -1 | -53 | -2 | 0 | -58 | 1,228 |
| TK8 | 0 | C12 | Max | 1 | 52 | 2 | 0 | 56 | 1,913 |
| TK8 | 36 | C12 | Max | 1 | 54 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C12 | Min | -1 | 33 | -2 | 0 | -56 | 1,208 |
| TK8 | 36 | C12 | Min | -1 | 35 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C12** | **MAX:** | **20** | **62** | **53** | **894** | **1,903** | **2,182** |

## D.13 Case-13

| Case-13: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C13 | Max | 78 | -45 | 10 | 501 | 2,535 | 489 |
| G01 | 146 | C13 | Max | 78 | -38 | 10 | 501 | 1,082 | 9,570 |
| G01 | 0 | C13 | Min | -78 | -69 | -10 | -499 | -2,524 | -498 |
| G01 | 146 | C13 | Min | -78 | -62 | -10 | -499 | -1,077 | 6,026 |
| G02 | 0 | C13 | Max | 68 | -39 | 12 | 501 | 1,082 | 9,570 |
| G02 | 138 | C13 | Max | 68 | -33 | 12 | 501 | 608 | 17,455 |
| G02 | 0 | C13 | Min | -68 | -61 | -12 | -499 | -1,077 | 6,026 |
| G02 | 138 | C13 | Min | -68 | -55 | -12 | -499 | -607 | 11,107 |
| G03 | 0 | C13 | Max | 59 | -34 | 11 | 501 | 608 | 17,455 |
| G03 | 174.5 | C13 | Max | 59 | -26 | 11 | 501 | 2,488 | 25,954 |
| G03 | 0 | C13 | Min | -59 | -54 | -11 | -499 | -607 | 11,107 |
| G03 | 174.5 | C13 | Min | -59 | -46 | -11 | -499 | -2,494 | 16,526 |
| G04 | 0 | C13 | Max | 49 | 14 | 2 | 155 | 2,488 | 25,987 |
| G04 | 36.5 | C13 | Max | 49 | 15 | 2 | 155 | 2,454 | 25,508 |
| G04 | 0 | C13 | Min | -49 | 4 | -2 | -160 | -2,494 | 16,493 |
| G04 | 36.5 | C13 | Min | -49 | 6 | -2 | -160 | -2,456 | 16,264 |
| G05 | 0 | C13 | Max | 44 | 16 | 2 | 155 | 2,454 | 25,508 |
| G05 | 109.5 | C13 | Max | 44 | 21 | 2 | 155 | 2,241 | 23,699 |
| G05 | 0 | C13 | Min | -44 | 5 | -3 | -160 | -2,456 | 16,264 |
| G05 | 109.5 | C13 | Min | -44 | 10 | -3 | -160 | -2,235 | 15,222 |
| G06 | 0 | C13 | Max | 38 | 52 | 11 | 556 | 2,241 | 23,699 |
| G06 | 101.5 | C13 | Max | 38 | 57 | 11 | 556 | 1,198 | 18,250 |
| G06 | 0 | C13 | Min | -38 | 31 | -11 | -557 | -2,235 | 15,222 |
| G06 | 101.5 | C13 | Min | -38 | 36 | -11 | -557 | -1,192 | 11,733 |
| G07 | 0 | C13 | Max | 31 | 57 | 11 | 556 | 1,198 | 18,250 |
| G07 | 138 | C13 | Max | 31 | 64 | 11 | 556 | 585 | 10,004 |
| G07 | 0 | C13 | Min | -31 | 35 | -11 | -557 | -1,192 | 11,733 |
| G07 | 138 | C13 | Min | -31 | 42 | -11 | -557 | -578 | 6,324 |
| G08 | 0 | C13 | Max | 23 | 65 | 10 | 556 | 585 | 10,004 |
| G08 | 146 | C13 | Max | 23 | 71 | 10 | 556 | 1,872 | 781 |
| G08 | 0 | C13 | Min | -23 | 41 | -10 | -557 | -578 | 6,324 |
| G08 | 146 | C13 | Min | -23 | 47 | -10 | -557 | -1,864 | -783 |
| G09 | 0 | C13 | Max | 71 | -43 | 10 | 503 | 2,523 | 554 |
| G09 | 146 | C13 | Max | 71 | -37 | 10 | 503 | 1,074 | 9,186 |
| G09 | 0 | C13 | Min | -71 | -66 | -10 | -505 | -2,527 | -545 |
| G09 | 146 | C13 | Min | -71 | -60 | -10 | -505 | -1,071 | 5,836 |
| G10 | 0 | C13 | Max | 62 | -38 | 12 | 503 | 1,074 | 9,186 |
| G10 | 138 | C13 | Max | 62 | -32 | 12 | 503 | 590 | 16,894 |
| G10 | 0 | C13 | Min | -62 | -59 | -12 | -505 | -1,071 | 5,836 |
| G10 | 138 | C13 | Min | -62 | -54 | -12 | -505 | -582 | 10,737 |
| G11 | 0 | C13 | Max | 52 | -33 | 11 | 503 | 590 | 16,894 |
| G11 | 174.5 | C13 | Max | 52 | -26 | 11 | 503 | 2,503 | 25,323 |
| G11 | 0 | C13 | Min | -52 | -53 | -11 | -505 | -582 | 10,737 |
| G11 | 174.5 | C13 | Min | -52 | -46 | -11 | -505 | -2,488 | 16,048 |
| G12 | 0 | C13 | Max | 43 | 14 | 2 | 148 | 2,503 | 25,285 |
| G12 | 36.5 | C13 | Max | 43 | 16 | 2 | 148 | 2,453 | 24,776 |
| G12 | 0 | C13 | Min | -44 | 5 | -2 | -144 | -2,488 | 16,085 |
| G12 | 36.5 | C13 | Min | -44 | 7 | -2 | -144 | -2,441 | 15,828 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C13 | Max | 39 | 16 | 3 | 148 | 2,453 | 24,776 |
| G13 | 109.5 | C13 | Max | 39 | 21 | 3 | 148 | 2,225 | 22,936 |
| G13 | 0 | C13 | Min | -39 | 6 | -3 | -144 | -2,441 | 15,828 |
| G13 | 109.5 | C13 | Min | -39 | 11 | -3 | -144 | -2,220 | 14,725 |
| G14 | 0 | C13 | Max | 34 | 51 | 11 | 554 | 2,225 | 22,936 |
| G14 | 101.5 | C13 | Max | 34 | 56 | 11 | 554 | 1,171 | 17,614 |
| G14 | 0 | C13 | Min | -34 | 31 | -11 | -554 | -2,220 | 14,725 |
| G14 | 101.5 | C13 | Min | -34 | 35 | -11 | -554 | -1,167 | 11,297 |
| G15 | 0 | C13 | Max | 28 | 56 | 11 | 554 | 1,171 | 17,614 |
| G15 | 138 | C13 | Max | 28 | 62 | 11 | 554 | 517 | 9,593 |
| G15 | 0 | C13 | Min | -28 | 34 | -11 | -554 | -1,167 | 11,297 |
| G15 | 138 | C13 | Min | -28 | 40 | -11 | -554 | -512 | 6,085 |
| G16 | 0 | C13 | Max | 21 | 63 | 10 | 554 | 517 | 9,593 |
| G16 | 146 | C13 | Max | 21 | 69 | 10 | 554 | 1,865 | 750 |
| G16 | 0 | C13 | Min | -21 | 39 | -10 | -554 | -512 | 6,085 |
| G16 | 146 | C13 | Min | -21 | 45 | -10 | -554 | -1,860 | -748 |
| | **Girders** | **C13** | **MAX:** | **78** | **71** | **12** | **557** | **2,535** | **25,987** |

**Case-13: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **End Ties** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| ET1 | 0 | C13 | Max | 8 | -1 | 9 | 0 | 1,081 | -29 |
| ET1 | 120 | C13 | Max | 8 | 0 | 9 | 0 | 68 | 50 |
| ET1 | 0 | C13 | Min | -8 | -2 | -9 | 0 | -1,104 | -76 |
| ET1 | 120 | C13 | Min | -8 | 0 | -9 | 0 | -69 | 3 |
| ET2 | 0 | C13 | Max | 7 | 0 | 9 | 0 | 68 | 50 |
| ET2 | 120 | C13 | Max | 7 | 2 | 9 | 0 | 1,098 | -27 |
| ET2 | 0 | C13 | Min | -7 | 0 | -9 | 0 | -69 | 3 |
| ET2 | 120 | C13 | Min | -7 | 1 | -9 | 0 | -1,078 | -78 |
| ET3 | 0 | C13 | Max | 11 | -1 | 16 | 0 | 1,875 | -27 |
| ET3 | 120 | C13 | Max | 11 | 0 | 16 | 0 | 101 | 53 |
| ET3 | 0 | C13 | Min | -11 | -2 | -16 | 0 | -1,868 | -78 |
| ET3 | 120 | C13 | Min | -11 | 0 | -16 | 0 | -100 | 0 |
| ET4 | 0 | C13 | Max | 10 | 0 | 16 | 0 | 101 | 53 |
| ET4 | 120 | C13 | Max | 10 | 2 | 16 | 0 | 1,862 | -24 |
| ET4 | 0 | C13 | Min | -10 | 0 | -16 | 0 | -100 | 0 |
| ET4 | 120 | C13 | Min | -10 | 1 | -16 | 0 | -1,867 | -81 |
| | **End Ties** | **C13** | **MAX:** | **11** | **2** | **16** | **0** | **1,875** | **81** |

**Case-13: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **Trucks** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| TK1 | 0 | C13 | Max | 15 | -18 | 43 | 725 | 0 | 265 |
| TK1 | 36 | C13 | Max | 15 | -16 | 43 | 725 | 1,540 | 1,367 |
| TK1 | 0 | C13 | Min | -15 | -43 | -43 | -727 | 0 | -265 |
| TK1 | 36 | C13 | Min | -15 | -41 | -43 | -727 | -1,544 | 742 |
| TK2 | 0 | C13 | Max | 1 | 43 | 51 | 854 | 1,823 | 1,568 |
| TK2 | 36 | C13 | Max | 1 | 45 | 51 | 854 | 0 | 0 |
| TK2 | 0 | C13 | Min | -1 | 17 | -50 | -858 | -1,815 | 646 |
| TK2 | 36 | C13 | Min | -1 | 19 | -50 | -858 | 0 | 0 |
| TK3 | 0 | C13 | Max | 1 | -22 | 45 | 752 | 0 | 0 |
| TK3 | 36 | C13 | Max | 1 | -20 | 45 | 752 | 1,601 | 1,386 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C13 | Min | -1 | -39 | -44 | -758 | 0 | 0 |
| TK3 | 36 | C13 | Min | -1 | -38 | -44 | -758 | -1,614 | 742 |
| TK4 | 0 | C13 | Max | 1 | 37 | 42 | 726 | 1,529 | 1,365 |
| TK4 | 36 | C13 | Max | 1 | 39 | 42 | 726 | 0 | 0 |
| TK4 | 0 | C13 | Min | -1 | 17 | -42 | -730 | -1,520 | 658 |
| TK4 | 36 | C13 | Min | -1 | 19 | -42 | -730 | 0 | 0 |
| TK5 | 0 | C13 | Max | 22 | -16 | 2 | 0 | 0 | 369 |
| TK5 | 36 | C13 | Max | 22 | -14 | 2 | 0 | 56 | 1,453 |
| TK5 | 0 | C13 | Min | -22 | -47 | -2 | 0 | 0 | -369 |
| TK5 | 36 | C13 | Min | -22 | -45 | -2 | 0 | -56 | 745 |
| TK6 | 0 | C13 | Max | 1 | 44 | 2 | 0 | 55 | 1,612 |
| TK6 | 36 | C13 | Max | 1 | 46 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C13 | Min | -1 | 18 | -2 | 0 | -55 | 691 |
| TK6 | 36 | C13 | Min | -1 | 20 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C13 | Max | 1 | -22 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C13 | Max | 1 | -20 | 2 | 0 | 60 | 1,438 |
| TK7 | 0 | C13 | Min | -1 | -41 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C13 | Min | -1 | -39 | -2 | 0 | -60 | 771 |
| TK8 | 0 | C13 | Max | 1 | 40 | 2 | 0 | 58 | 1,461 |
| TK8 | 36 | C13 | Max | 1 | 42 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C13 | Min | -1 | 17 | -2 | 0 | -58 | 644 |
| TK8 | 36 | C13 | Min | -1 | 19 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C13** | **MAX:** | **22** | **47** | **51** | **858** | **1,823** | **1,612** |

## D.14 Case-14

| Case-14: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C14 | Max | 80 | -30 | 7 | 144 | 2,486 | 555 |
| G01 | 146 | C14 | Max | 80 | -23 | 7 | 144 | 1,992 | 6,454 |
| G01 | 0 | C14 | Min | -80 | -48 | -7 | -143 | -2,480 | -560 |
| G01 | 146 | C14 | Min | -80 | -41 | -7 | -143 | -1,988 | 3,893 |
| G02 | 0 | C14 | Max | 72 | -26 | 7 | 144 | 1,992 | 6,454 |
| G02 | 138 | C14 | Max | 72 | -20 | 7 | 144 | 1,796 | 11,200 |
| G02 | 0 | C14 | Min | -72 | -38 | -7 | -143 | -1,988 | 3,893 |
| G02 | 138 | C14 | Min | -72 | -32 | -7 | -143 | -1,793 | 7,150 |
| G03 | 0 | C14 | Max | 64 | -20 | 7 | 144 | 1,796 | 11,200 |
| G03 | 174.5 | C14 | Max | 64 | -13 | 7 | 144 | 1,232 | 15,430 |
| G03 | 0 | C14 | Min | -64 | -31 | -7 | -143 | -1,793 | 7,150 |
| G03 | 174.5 | C14 | Min | -64 | -23 | -7 | -143 | -1,232 | 10,561 |
| G04 | 0 | C14 | Max | 58 | -12 | 8 | 144 | 1,232 | 15,430 |
| G04 | 36.5 | C14 | Max | 58 | -10 | 8 | 144 | 1,185 | 16,078 |
| G04 | 0 | C14 | Min | -57 | -24 | -8 | -143 | -1,232 | 10,561 |
| G04 | 36.5 | C14 | Min | -57 | -22 | -8 | -143 | -1,185 | 11,161 |
| G05 | 0 | C14 | Max | 52 | -9 | 9 | 144 | 1,185 | 16,078 |
| G05 | 138 | C14 | Max | 52 | -3 | 9 | 144 | 1,275 | 18,202 |
| G05 | 0 | C14 | Min | -52 | -23 | -9 | -143 | -1,185 | 11,161 |
| G05 | 138 | C14 | Min | -52 | -17 | -9 | -143 | -1,277 | 12,663 |
| G06 | 0 | C14 | Max | 46 | -2 | 10 | 144 | 1,275 | 18,202 |
| G06 | 73 | C14 | Max | 46 | 1 | 10 | 144 | 1,602 | 19,163 |
| G06 | 0 | C14 | Min | -46 | -18 | -10 | -143 | -1,277 | 12,663 |
| G06 | 73 | C14 | Min | -46 | -14 | -10 | -143 | -1,605 | 12,919 |
| G07 | 0 | C14 | Max | 35 | 45 | 9 | 337 | 1,602 | 19,028 |
| G07 | 146 | C14 | Max | 35 | 51 | 9 | 337 | 1,968 | 12,469 |
| G07 | 0 | C14 | Min | -35 | 28 | -9 | -336 | -1,605 | 13,055 |
| G07 | 146 | C14 | Min | -35 | 35 | -9 | -336 | -1,972 | 7,980 |
| G08 | 0 | C14 | Max | 28 | 85 | 11 | 459 | 1,968 | 12,469 |
| G08 | 138 | C14 | Max | 28 | 92 | 11 | 459 | 2,568 | 1,049 |
| G08 | 0 | C14 | Min | -28 | 57 | -11 | -464 | -1,972 | 7,980 |
| G08 | 138 | C14 | Min | -28 | 63 | -11 | -464 | -2,559 | -1,050 |
| G09 | 0 | C14 | Max | 68 | -28 | 7 | 148 | 2,555 | 564 |
| G09 | 146 | C14 | Max | 68 | -22 | 7 | 148 | 1,969 | 6,186 |
| G09 | 0 | C14 | Min | -68 | -45 | -8 | -149 | -2,558 | -558 |
| G09 | 146 | C14 | Min | -68 | -40 | -8 | -149 | -1,969 | 3,719 |
| G10 | 0 | C14 | Max | 60 | -25 | 7 | 148 | 1,969 | 6,186 |
| G10 | 138 | C14 | Max | 60 | -20 | 7 | 148 | 1,676 | 10,766 |
| G10 | 0 | C14 | Min | -60 | -37 | -7 | -149 | -1,969 | 3,719 |
| G10 | 138 | C14 | Min | -60 | -31 | -7 | -149 | -1,673 | 6,913 |
| G11 | 0 | C14 | Max | 52 | -20 | 7 | 148 | 1,676 | 10,766 |
| G11 | 174.5 | C14 | Max | 52 | -13 | 7 | 148 | 1,262 | 14,974 |
| G11 | 0 | C14 | Min | -52 | -31 | -7 | -149 | -1,673 | 6,913 |
| G11 | 174.5 | C14 | Min | -52 | -24 | -7 | -149 | -1,256 | 10,331 |
| G12 | 0 | C14 | Max | 48 | -12 | 7 | 148 | 1,262 | 14,974 |
| G12 | 36.5 | C14 | Max | 48 | -10 | 7 | 148 | 1,185 | 15,678 |
| G12 | 0 | C14 | Min | -48 | -25 | -7 | -149 | -1,256 | 10,331 |
| G12 | 36.5 | C14 | Min | -48 | -23 | -7 | -149 | -1,179 | 10,912 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C14 | Max | 44 | -10 | 9 | 148 | 1,185 | 15,678 |
| G13 | 138 | C14 | Max | 44 | -4 | 9 | 148 | 1,286 | 18,152 |
| G13 | 0 | C14 | Min | -44 | -24 | -9 | -149 | -1,179 | 10,912 |
| G13 | 138 | C14 | Min | -44 | -19 | -9 | -149 | -1,278 | 12,319 |
| G14 | 0 | C14 | Max | 39 | -4 | 9 | 148 | 1,286 | 18,152 |
| G14 | 73 | C14 | Max | 39 | -1 | 9 | 148 | 1,602 | 19,300 |
| G14 | 0 | C14 | Min | -39 | -19 | -9 | -149 | -1,278 | 12,319 |
| G14 | 73 | C14 | Min | -39 | -16 | -9 | -149 | -1,592 | 12,602 |
| G15 | 0 | C14 | Max | 29 | 48 | 10 | 398 | 1,602 | 18,962 |
| G15 | 146 | C14 | Max | 29 | 54 | 10 | 398 | 1,957 | 11,956 |
| G15 | 0 | C14 | Min | -29 | 30 | -10 | -398 | -1,592 | 12,940 |
| G15 | 146 | C14 | Min | -29 | 35 | -10 | -398 | -1,946 | 7,741 |
| G16 | 0 | C14 | Max | 24 | 83 | 11 | 454 | 1,957 | 11,956 |
| G16 | 138 | C14 | Max | 24 | 88 | 11 | 454 | 2,562 | 1,025 |
| G16 | 0 | C14 | Min | -24 | 54 | -10 | -449 | -1,946 | 7,741 |
| G16 | 138 | C14 | Min | -24 | 60 | -10 | -449 | -2,562 | -1,023 |
| | **Girders** | **C14** | **MAX:** | **80** | **92** | **11** | **464** | **2,568** | **19,300** |

**Case-14: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| End Ties | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | C14 | Max | 12 | -1 | 8 | 0 | 950 | -19 |
| ET1 | 120 | C14 | Max | 12 | 1 | 8 | 0 | 86 | 60 |
| ET1 | 0 | C14 | Min | -12 | -2 | -8 | 0 | -964 | -86 |
| ET1 | 120 | C14 | Min | -12 | -1 | -8 | 0 | -87 | -7 |
| ET2 | 0 | C14 | Max | 11 | 1 | 8 | 0 | 86 | 60 |
| ET2 | 120 | C14 | Max | 11 | 2 | 8 | 0 | 969 | -19 |
| ET2 | 0 | C14 | Min | -11 | -1 | -8 | 0 | -87 | -7 |
| ET2 | 120 | C14 | Min | -11 | 1 | -8 | 0 | -957 | -86 |
| ET3 | 0 | C14 | Max | 12 | -1 | 21 | 0 | 2,572 | -19 |
| ET3 | 120 | C14 | Max | 12 | 1 | 21 | 0 | 87 | 59 |
| ET3 | 0 | C14 | Min | -12 | -2 | -21 | 0 | -2,563 | -86 |
| ET3 | 120 | C14 | Min | -12 | -1 | -21 | 0 | -82 | -6 |
| ET4 | 0 | C14 | Max | 10 | 1 | 21 | 0 | 87 | 59 |
| ET4 | 120 | C14 | Max | 10 | 2 | 21 | 0 | 2,566 | -20 |
| ET4 | 0 | C14 | Min | -10 | -1 | -21 | 0 | -82 | -6 |
| ET4 | 120 | C14 | Min | -10 | 1 | -21 | [illegible] | -2,565 | -85 |
| | **End Ties** | **C14** | **MAX:** | **12** | **2** | **21** | **0** | [illegible] | **86** |

**Case-14: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | C14 | Max | 21 | -10 | 55 | 904 | 0 | 356 |
| TK1 | 36 | C14 | Max | 21 | -8 | 55 | 904 | 1,967 | 957 |
| TK1 | 0 | C14 | Min | -21 | -33 | -55 | -905 | 0 | -356 |
| TK1 | 36 | C14 | Min | -21 | -31 | -55 | -905 | -1,970 | 505 |
| TK2 | 0 | C14 | Max | 1 | 35 | 48 | 801 | 1,711 | 1,296 |
| TK2 | 36 | C14 | Max | 1 | 37 | 48 | 801 | 0 | 0 |
| TK2 | 0 | C14 | Min | -1 | 7 | -47 | -804 | -1,706 | 270 |
| TK2 | 36 | C14 | Min | -1 | 8 | -47 | -804 | 0 | 0 |
| TK3 | 0 | C14 | Max | 1 | -11 | 42 | 707 | 0 | 0 |
| TK3 | 36 | C14 | Max | 1 | -9 | 42 | 707 | 1,489 | 1,149 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C14 | Min | -1 | -33 | -41 | -711 | 0 | 0 |
| TK3 | 36 | C14 | Min | -1 | -31 | -41 | -711 | -1,497 | 348 |
| TK4 | 0 | C14 | Max | 1 | 26 | 48 | 813 | 1,723 | 965 |
| TK4 | 36 | C14 | Max | 1 | 28 | 48 | 813 | 0 | 0 |
| TK4 | 0 | C14 | Min | -1 | 11 | -48 | -815 | -1,717 | 427 |
| TK4 | 36 | C14 | Min | -1 | 13 | -48 | -815 | 0 | 0 |
| TK5 | 0 | C14 | Max | 22 | -24 | 2 | 1 | 0 | 380 |
| TK5 | 36 | C14 | Max | 22 | -22 | 2 | 1 | 62 | 1,786 |
| TK5 | 0 | C14 | Min | -22 | -57 | -2 | -1 | 0 | -380 |
| TK5 | 36 | C14 | Min | -22 | -55 | -2 | -1 | -62 | 1,060 |
| TK6 | 0 | C14 | Max | 1 | 55 | 2 | 0 | 65 | 2,028 |
| TK6 | 36 | C14 | Max | 1 | 57 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C14 | Min | -1 | 25 | -2 | 0 | -65 | 922 |
| TK6 | 36 | C14 | Min | -1 | 27 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C14 | Max | 1 | -31 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C14 | Max | 1 | -29 | 2 | 0 | 57 | 1,750 |
| TK7 | 0 | C14 | Min | -1 | -50 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C14 | Min | -1 | -48 | -2 | 0 | -57 | 1,089 |
| TK8 | 0 | C14 | Max | 1 | 47 | 2 | 0 | 59 | 1,720 |
| TK8 | 36 | C14 | Max | 1 | 49 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C14 | Min | -1 | 27 | -2 | 0 | -59 | 1,015 |
| TK8 | 36 | C14 | Min | -1 | 29 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C14** | **MAX:** | **22** | **57** | **55** | **905** | **1,970** | **2,028** |

## D.15 Case-15

| Case-15: Element Forces - Frames | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girders | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | C15 | Max | 81 | -23 | 7 | 75 | 2,130 | 475 |
| G01 | 146 | C15 | Max | 81 | -16 | 7 | 75 | 1,744 | 4,684 |
| G01 | 0 | C15 | Min | -81 | -35 | -7 | -74 | -2,125 | -480 |
| G01 | 146 | C15 | Min | -81 | -28 | -7 | -74 | -1,741 | 2,780 |
| G02 | 0 | C15 | Max | 73 | -18 | 6 | 75 | 1,744 | 4,684 |
| G02 | 138 | C15 | Max | 73 | -12 | 6 | 75 | 1,626 | 7,775 |
| G02 | 0 | C15 | Min | -73 | -27 | -6 | -74 | -1,741 | 2,780 |
| G02 | 138 | C15 | Min | -73 | -20 | -6 | -74 | -1,625 | 4,967 |
| G03 | 0 | C15 | Max | 63 | -13 | 6 | 75 | 1,626 | 7,775 |
| G03 | 174.5 | C15 | Max | 63 | -5 | 6 | 75 | 1,184 | 10,239 |
| G03 | 0 | C15 | Min | -63 | -19 | -6 | -74 | -1,625 | 4,967 |
| G03 | 174.5 | C15 | Min | -63 | -11 | -6 | -74 | -1,184 | 6,698 |
| G04 | 0 | C15 | Max | 57 | -5 | 6 | 75 | 1,184 | 10,239 |
| G04 | 36.5 | C15 | Max | 57 | -3 | 6 | 75 | 1,126 | 10,534 |
| G04 | 0 | C15 | Min | -57 | -11 | -6 | -74 | -1,184 | 6,698 |
| G04 | 36.5 | C15 | Min | -57 | -9 | -6 | -74 | -1,127 | 6,931 |
| G05 | 0 | C15 | Max | 52 | -3 | 7 | 75 | 1,126 | 10,534 |
| G05 | 129.5 | C15 | Max | 52 | 3 | 7 | 75 | 898 | 11,020 |
| G05 | 0 | C15 | Min | -52 | -9 | -7 | -74 | -1,127 | 6,931 |
| G05 | 129.5 | C15 | Min | -52 | -4 | -7 | -74 | -900 | 7,339 |
| G06 | 0 | C15 | Max | 46 | 3 | 8 | 75 | 898 | 11,020 |
| G06 | 81.5 | C15 | Max | 46 | 7 | 8 | 75 | 1,027 | 10,876 |
| G06 | 0 | C15 | Min | -46 | -4 | -8 | -74 | -900 | 7,339 |
| G06 | 81.5 | C15 | Min | -46 | 0 | -8 | -74 | -1,029 | 7,264 |
| G07 | 0 | C15 | Max | 39 | 7 | 9 | 75 | 1,027 | 10,876 |
| G07 | 138 | C15 | Max | 39 | 13 | 9 | 75 | 1,919 | 9,971 |
| G07 | 0 | C15 | Min | -39 | -1 | -9 | -74 | -1,029 | 7,264 |
| G07 | 138 | C15 | Min | -39 | 6 | -9 | -74 | -1,923 | 6,422 |
| G08 | 0 | C15 | Max | 28 | 64 | 9 | 403 | 1,919 | 9,755 |
| G08 | 146 | C15 | Max | 28 | 71 | 9 | 403 | 2,446 | 1,010 |
| G08 | 0 | C15 | Min | -28 | 42 | -9 | -406 | -1,923 | 6,638 |
| G08 | 146 | C15 | Min | -28 | 48 | -9 | -406 | -2,439 | -1,011 |
| G09 | 0 | C15 | Max | 67 | -22 | 7 | 73 | 1,966 | 483 |
| G09 | 146 | C15 | Max | 67 | -16 | 7 | 73 | 1,733 | 4,254 |
| G09 | 0 | C15 | Min | -67 | -32 | -7 | -75 | -1,969 | -478 |
| G09 | 146 | C15 | Min | -67 | -26 | -7 | -75 | -1,734 | 2,754 |
| G10 | 0 | C15 | Max | 59 | -17 | 6 | 73 | 1,733 | 4,254 |
| G10 | 138 | C15 | Max | 59 | -11 | 6 | 73 | 1,533 | 7,237 |
| G10 | 0 | C15 | Min | -59 | -25 | -6 | -75 | -1,734 | 2,754 |
| G10 | 138 | C15 | Min | -59 | -19 | -6 | -75 | -1,532 | 4,807 |
| G11 | 0 | C15 | Max | 51 | -12 | 5 | 73 | 1,533 | 7,237 |
| G11 | 174.5 | C15 | Max | 51 | -5 | 5 | 73 | 1,115 | 9,758 |
| G11 | 0 | C15 | Min | -51 | -19 | -5 | -75 | -1,532 | 4,807 |
| G11 | 174.5 | C15 | Min | -51 | -12 | -5 | -75 | -1,111 | 6,450 |
| G12 | 0 | C15 | Max | 45 | -6 | 6 | 73 | 1,115 | 9,758 |
| G12 | 36.5 | C15 | Max | 45 | -5 | 6 | 73 | 1,045 | 10,094 |
| G12 | 0 | C15 | Min | -45 | -11 | -6 | -75 | -1,111 | 6,450 |
| G12 | 36.5 | C15 | Min | -45 | -9 | -6 | -75 | -1,041 | 6,674 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G13 | 0 | C15 | Max | 40 | -5 | 7 | 73 | 1,045 | 10,094 |
| G13 | 129.5 | C15 | Max | 40 | 0 | 7 | 73 | 870 | 10,763 |
| G13 | 0 | C15 | Min | -40 | -9 | -7 | -75 | -1,041 | 6,674 |
| G13 | 129.5 | C15 | Min | -40 | -4 | -7 | -75 | -863 | 7,124 |
| G14 | 0 | C15 | Max | 35 | 1 | 7 | 73 | 870 | 10,763 |
| G14 | 81.5 | C15 | Max | 35 | 4 | 7 | 73 | 1,010 | 10,794 |
| G14 | 0 | C15 | Min | -35 | -4 | -7 | -75 | -863 | 7,124 |
| G14 | 81.5 | C15 | Min | -35 | -1 | -7 | -75 | -1,002 | 7,102 |
| G15 | 0 | C15 | Max | 31 | 6 | 8 | 73 | 1,010 | 10,794 |
| G15 | 138 | C15 | Max | 31 | 11 | 8 | 73 | 1,817 | 10,163 |
| G15 | 0 | C15 | Min | -31 | -2 | -9 | -75 | -1,002 | 7,102 |
| G15 | 138 | C15 | Min | -31 | 3 | -9 | -75 | -1,807 | 6,523 |
| G16 | 0 | C15 | Max | 24 | 65 | 9 | 440 | 1,817 | 9,923 |
| G16 | 146 | C15 | Max | 24 | 71 | 9 | 440 | 2,445 | 989 |
| G16 | 0 | C15 | Min | -24 | 43 | -9 | -437 | -1,807 | 6,763 |
| G16 | 146 | C15 | Min | -24 | 49 | -9 | -437 | -2,445 | -987 |
| | **Girders** | **C15** | **MAX:** | **81** | **71** | **9** | **440** | **2,446** | **11,020** |

**Case-15: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **End Ties** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| ET1 | 0 | C15 | Max | 10 | -1 | 6 | 0 | 790 | -40 |
| ET1 | 120 | C15 | Max | 10 | 0 | 6 | 0 | 89 | 39 |
| ET1 | 0 | C15 | Min | -10 | -2 | -7 | 0 | -803 | -65 |
| ET1 | 120 | C15 | Min | -10 | 0 | -7 | 0 | -90 | 14 |
| ET2 | 0 | C15 | Max | 9 | 0 | 7 | 0 | 89 | 39 |
| ET2 | 120 | C15 | Max | 9 | 2 | 7 | 0 | 774 | -41 |
| ET2 | 0 | C15 | Min | -9 | 0 | -7 | 0 | -90 | 14 |
| ET2 | 120 | C15 | Min | -9 | 1 | -7 | 0 | -763 | -64 |
| ET3 | 0 | C15 | Max | 7 | -1 | 20 | 0 | 2,444 | -36 |
| ET3 | 120 | C15 | Max | 7 | 0 | 20 | 0 | 86 | 40 |
| ET3 | 0 | C15 | Min | 0 | -2 | -20 | 0 | -2,438 | -68 |
| ET3 | 120 | C15 | Min | 0 | 0 | -20 | 0 | -83 | 13 |
| ET4 | 0 | C15 | Max | 6 | 0 | 20 | 0 | 86 | 40 |
| ET4 | 120 | C15 | Max | 6 | 2 | 20 | 0 | 2,442 | -40 |
| ET4 | 0 | C15 | Min | 0 | 0 | -20 | 0 | -83 | 13 |
| ET4 | 120 | C15 | Min | 0 | 1 | -20 | 0 | -2,442 | -65 |
| | **End Ties** | **C15** | **MAX:** | **10** | **2** | **20** | **0** | **2,444** | **68** |

**Case-15: Element Forces - Frames**

| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
|---|---|---|---|---|---|---|---|---|---|
| **Trucks** | **in** | **Case** | **Type** | **Kip** | **Kip** | **Kip** | **Kip-in** | **Kip-in** | **Kip-in** |
| TK1 | 0 | C15 | Max | 17 | -7 | 53 | 889 | 0 | 294 |
| TK1 | 36 | C15 | Max | 17 | -5 | 53 | 889 | 1,890 | 700 |
| TK1 | 0 | C15 | Min | -17 | -25 | -52 | -890 | 0 | -294 |
| TK1 | 36 | C15 | Min | -17 | -23 | -52 | -890 | -1,892 | 406 |
| TK2 | 0 | C15 | Max | 1 | 25 | 46 | 780 | 1,660 | 942 |
| TK2 | 36 | C15 | Max | 1 | 27 | 46 | 780 | 0 | 0 |
| TK2 | 0 | C15 | Min | -1 | 6 | -46 | -783 | -1,654 | 268 |
| TK2 | 36 | C15 | Min | -1 | 8 | -46 | -783 | 0 | 0 |
| TK3 | 0 | C15 | Max | 1 | -10 | 41 | 702 | 0 | 0 |
| TK3 | 36 | C15 | Max | 1 | -8 | 41 | 702 | 1,465 | 817 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TK3 | 0 | C15 | Min | -1 | -24 | -41 | -706 | 0 | 0 |
| TK3 | 36 | C15 | Min | -1 | -22 | -41 | -706 | -1,473 | 323 |
| TK4 | 0 | C15 | Max | 1 | 19 | 47 | 797 | 1,691 | 714 |
| TK4 | 36 | C15 | Max | 1 | 21 | 47 | 797 | 0 | 0 |
| TK4 | 0 | C15 | Min | -1 | 8 | -47 | -800 | -1,685 | 321 |
| TK4 | 36 | C15 | Min | -1 | 10 | -47 | -800 | 0 | 0 |
| TK5 | 0 | C15 | Max | 18 | -29 | 2 | 1 | 0 | 312 |
| TK5 | 36 | C15 | Max | 18 | -27 | 2 | 1 | 64 | 2,041 |
| TK5 | 0 | C15 | Min | -18 | -63 | -2 | -1 | 0 | -312 |
| TK5 | 36 | C15 | Min | -18 | -61 | -2 | -1 | -64 | 1,188 |
| TK6 | 0 | C15 | Max | 1 | 60 | 2 | 0 | 60 | 2,181 |
| TK6 | 36 | C15 | Max | 1 | 62 | 2 | 0 | 0 | 0 |
| TK6 | 0 | C15 | Min | -1 | 29 | -2 | 0 | -60 | 1,097 |
| TK6 | 36 | C15 | Min | -1 | 31 | -2 | 0 | 0 | 0 |
| TK7 | 0 | C15 | Max | 1 | -35 | 2 | 0 | 0 | 0 |
| TK7 | 36 | C15 | Max | 1 | -33 | 2 | 0 | 65 | 1,927 |
| TK7 | 0 | C15 | Min | -1 | -55 | -2 | 0 | 0 | 0 |
| TK7 | 36 | C15 | Min | -1 | -53 | -2 | 0 | -65 | 1,241 |
| TK8 | 0 | C15 | Max | 1 | 54 | 2 | 0 | 58 | 1,967 |
| TK8 | 36 | C15 | Max | 1 | 56 | 2 | 0 | 0 | 0 |
| TK8 | 0 | C15 | Min | -1 | 31 | -2 | 0 | -58 | 1,154 |
| TK8 | 36 | C15 | Min | -1 | 33 | -2 | 0 | 0 | 0 |
| | **Trucks** | **C15** | **MAX:** | **18** | **63** | **53** | **890** | **1,892** | **2,181** |

# CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT E
## JOINT RELATIVE DISPLACEMENTS

### Tabularized Selected Design Output

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**Case-01**

| Case-01: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C01 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C01 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C01 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C01 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C01 | Max | 0.00 | 5.71 | 0.00 | -0.00011 | 0.00433 | 0.00076 |
| 10 | C01 | Min | 0.00 | -5.71 | 0.00 | -0.00028 | 0.00092 | -0.00076 |
| 11 | C01 | Max | 0.00 | 5.72 | 0.00 | 0.00028 | 0.00451 | 0.00067 |
| 11 | C01 | Min | 0.00 | -5.71 | 0.00 | 0.00012 | 0.00074 | -0.00067 |
| 12 | C01 | Max | 0.00 | 5.72 | 0.00 | -0.00012 | 0.00429 | 0.00065 |
| 12 | C01 | Min | 0.00 | -5.71 | 0.00 | -0.00027 | 0.00089 | -0.00065 |
| 13 | C01 | Max | 0.00 | 5.72 | 0.00 | 0.00027 | 0.00426 | 0.00063 |
| 13 | C01 | Min | 0.00 | -5.71 | 0.00 | 0.00012 | 0.00091 | -0.00063 |
| 14 | C01 | Max | 0.08 | 5.67 | 0.00 | -0.00013 | -0.00167 | 0.00091 |
| 14 | C01 | Min | -0.07 | -5.67 | 0.00 | -0.00031 | -0.00378 | -0.00091 |
| 15 | C01 | Max | 0.06 | 5.68 | 0.00 | 0.00031 | -0.00167 | 0.00089 |
| 15 | C01 | Min | -0.05 | -5.67 | 0.00 | 0.00013 | -0.00378 | -0.00090 |
| 16 | C01 | Max | 0.07 | 5.67 | 0.00 | -0.00014 | -0.00164 | 0.00092 |
| 16 | C01 | Min | -0.05 | -5.67 | 0.00 | -0.00030 | -0.00372 | -0.00095 |
| 17 | C01 | Max | 0.07 | 5.68 | 0.00 | 0.00030 | -0.00164 | 0.00091 |
| 17 | C01 | Min | -0.05 | -5.67 | 0.00 | 0.00013 | -0.00372 | -0.00093 |
| 21 | C01 | Max | 0.07 | 5.72 | 0.00 | -0.00011 | 0.00433 | 0.00076 |
| 21 | C01 | Min | 0.02 | -5.71 | 0.00 | -0.00028 | 0.00092 | -0.00076 |
| 22 | C01 | Max | 0.07 | 5.72 | 0.00 | 0.00028 | 0.00451 | 0.00067 |
| 22 | C01 | Min | 0.01 | -5.71 | 0.00 | 0.00012 | 0.00074 | -0.00067 |
| 23 | C01 | Max | 0.07 | 5.72 | 0.00 | -0.00012 | 0.00429 | 0.00065 |
| 23 | C01 | Min | 0.01 | -5.71 | 0.00 | -0.00027 | 0.00089 | -0.00065 |
| 24 | C01 | Max | 0.07 | 5.72 | 0.00 | 0.00027 | 0.00426 | 0.00063 |
| 24 | C01 | Min | 0.01 | -5.71 | 0.00 | 0.00012 | 0.00091 | -0.00063 |
| 25 | C01 | Max | 0.04 | 5.68 | 0.00 | -0.00013 | -0.00167 | 0.00091 |
| 25 | C01 | Min | -0.11 | -5.67 | 0.00 | -0.00031 | -0.00378 | -0.00091 |
| 26 | C01 | Max | 0.02 | 5.68 | 0.00 | 0.00031 | -0.00167 | 0.00089 |
| 26 | C01 | Min | -0.09 | -5.67 | 0.00 | 0.00013 | -0.00378 | -0.00090 |
| 27 | C01 | Max | 0.02 | 5.68 | 0.00 | -0.00014 | -0.00164 | 0.00092 |
| 27 | C01 | Min | -0.10 | -5.67 | 0.00 | -0.00030 | -0.00372 | -0.00095 |
| 28 | C01 | Max | 0.03 | 5.68 | 0.00 | 0.00030 | -0.00164 | 0.00091 |
| 28 | C01 | Min | -0.10 | -5.67 | 0.00 | 0.00013 | -0.00372 | -0.00093 |
| 100 | C01 | Max | 0.08 | 5.72 | 0.00 | 0.00001 | 0.00364 | 0.00048 |
| 100 | C01 | Min | 0.00 | -5.71 | -0.01 | -0.00002 | 0.00161 | -0.00048 |
| 101 | C01 | Max | 0.04 | 5.72 | 0.00 | 0.00001 | 0.00364 | 0.00049 |
| 101 | C01 | Min | -0.04 | -5.71 | -0.01 | -0.00002 | 0.00161 | -0.00049 |
| 102 | C01 | Max | 0.05 | 5.75 | -0.23 | 0.00028 | 0.00332 | 0.00149 |
| 102 | C01 | Min | -0.04 | -5.74 | -0.52 | -0.00028 | 0.00147 | -0.00150 |
| 103 | C01 | Max | 0.05 | 5.80 | -0.41 | 0.00053 | 0.00243 | 0.00162 |
| 103 | C01 | Min | -0.04 | -5.79 | -0.92 | -0.00053 | 0.00107 | -0.00163 |
| 104 | C01 | Max | 0.05 | 5.84 | -0.53 | 0.00084 | 0.00056 | 0.00065 |
| 104 | C01 | Min | -0.05 | -5.83 | -1.20 | -0.00084 | 0.00024 | -0.00066 |

| Case-01: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C01 | Max | 0.05 | 5.84 | -0.53 | 0.00083 | 0.00009 | 0.00037 |
| 105 | C01 | Min | -0.05 | -5.84 | -1.21 | -0.00083 | 0.00003 | -0.00037 |
| 106 | C01 | Max | 0.06 | 5.83 | -0.51 | 0.00079 | -0.00058 | 0.00083 |
| 106 | C01 | Min | -0.05 | -5.82 | -1.14 | -0.00079 | -0.00131 | -0.00084 |
| 107 | C01 | Max | 0.06 | 5.80 | -0.42 | 0.00059 | -0.00107 | 0.00139 |
| 107 | C01 | Min | -0.05 | -5.79 | -0.95 | -0.00059 | -0.00242 | -0.00139 |
| 108 | C01 | Max | 0.06 | 5.73 | -0.24 | 0.00031 | -0.00151 | 0.00154 |
| 108 | C01 | Min | -0.05 | -5.73 | -0.54 | -0.00031 | -0.00341 | -0.00154 |
| 109 | C01 | Max | 0.06 | 5.68 | 0.00 | 0.00002 | -0.00167 | 0.00091 |
| 109 | C01 | Min | -0.05 | -5.67 | -0.01 | -0.00002 | -0.00378 | -0.00091 |
| 110 | C01 | Max | 0.02 | 5.68 | 0.00 | 0.00002 | -0.00167 | 0.00090 |
| 110 | C01 | Min | -0.09 | -5.67 | -0.01 | -0.00002 | -0.00378 | -0.00090 |
| 200 | C01 | Max | 0.08 | 5.72 | 0.00 | 0.00002 | 0.00359 | 0.00047 |
| 200 | C01 | Min | 0.01 | -5.71 | -0.01 | -0.00001 | 0.00158 | -0.00047 |
| 201 | C01 | Max | 0.04 | 5.72 | 0.00 | 0.00002 | 0.00359 | 0.00048 |
| 201 | C01 | Min | -0.03 | -5.71 | -0.01 | -0.00001 | 0.00158 | -0.00048 |
| 202 | C01 | Max | 0.04 | 5.75 | -0.23 | 0.00027 | 0.00327 | 0.00149 |
| 202 | C01 | Min | -0.03 | -5.74 | -0.51 | -0.00027 | 0.00144 | -0.00148 |
| 203 | C01 | Max | 0.04 | 5.80 | -0.40 | 0.00052 | 0.00240 | 0.00163 |
| 203 | C01 | Min | -0.04 | -5.79 | -0.91 | -0.00052 | 0.00105 | -0.00162 |
| 204 | C01 | Max | 0.05 | 5.84 | -0.52 | 0.00084 | 0.00056 | 0.00065 |
| 204 | C01 | Min | -0.04 | -5.83 | -1.18 | -0.00084 | 0.00024 | -0.00065 |
| 205 | C01 | Max | 0.05 | 5.85 | -0.53 | 0.00082 | 0.00009 | 0.00037 |
| 205 | C01 | Min | -0.04 | -5.83 | -1.19 | -0.00082 | 0.00003 | -0.00037 |
| 206 | C01 | Max | 0.05 | 5.83 | -0.50 | 0.00078 | -0.00057 | 0.00082 |
| 206 | C01 | Min | -0.04 | -5.82 | -1.13 | -0.00078 | -0.00129 | -0.00083 |
| 207 | C01 | Max | 0.05 | 5.80 | -0.41 | 0.00058 | -0.00105 | 0.00137 |
| 207 | C01 | Min | -0.04 | -5.79 | -0.94 | -0.00058 | -0.00239 | -0.00138 |
| 208 | C01 | Max | 0.05 | 5.73 | -0.24 | 0.00030 | -0.00148 | 0.00154 |
| 208 | C01 | Min | -0.04 | -5.73 | -0.53 | -0.00030 | -0.00336 | -0.00156 |
| 209 | C01 | Max | 0.05 | 5.68 | 0.00 | 0.00002 | -0.00164 | 0.00092 |
| 209 | C01 | Min | -0.04 | -5.67 | -0.01 | -0.00002 | -0.00372 | -0.00094 |
| 210 | C01 | Max | 0.01 | 5.68 | 0.00 | 0.00002 | -0.00164 | 0.00091 |
| 210 | C01 | Min | -0.08 | -5.67 | -0.01 | -0.00002 | -0.00372 | -0.00094 |
| 301 | C01 | Max | 13.08 | 5.85 | -0.53 | 0.00004 | -0.00013 | 0.00034 |
| 301 | C01 | Min | -13.04 | -5.85 | -1.20 | -0.00007 | -0.00031 | -0.00035 |
| 302 | C01 | Max | 13.08 | 5.85 | -0.52 | 0.00019 | -0.00013 | 0.00035 |
| 302 | C01 | Min | -13.03 | -5.85 | -1.18 | 0.00005 | -0.00030 | -0.00035 |
| 303 | C01 | Max | 13.08 | 5.84 | -0.51 | 0.00004 | -0.00019 | 0.00035 |
| 303 | C01 | Min | -13.04 | -5.83 | -1.14 | -0.00008 | -0.00044 | -0.00035 |
| 304 | C01 | Max | 13.08 | 5.84 | -0.50 | 0.00019 | -0.00019 | 0.00035 |
| 304 | C01 | Min | -13.03 | -5.83 | -1.13 | 0.00006 | -0.00044 | -0.00035 |
| 401 | C01 | Max | 13.08 | 5.85 | -0.53 | 0.00004 | -0.00013 | 0.00034 |
| 401 | C01 | Min | -13.03 | -5.85 | -1.20 | -0.00007 | -0.00031 | -0.00035 |
| 402 | C01 | Max | 13.08 | 5.86 | -0.52 | 0.00019 | -0.00013 | 0.00035 |
| 402 | C01 | Min | -13.03 | -5.84 | -1.18 | 0.00005 | -0.00030 | -0.00035 |
| 500 | C01 | Max | 12.70 | 6.33 | -0.58 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C01 | Min | -12.66 | -6.32 | -1.32 | 0.00000 | 0.00000 | 0.00000 |

| Case-01: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C01 | Max | 13.08 | 5.85 | -0.52 | 0.00011 | -0.00017 | 0.00035 |
| 501 | C01 | Min | -13.04 | -5.84 | -1.17 | 0.00000 | -0.00038 | -0.00035 |
| 600 | C01 | Max | 12.63 | 6.39 | -0.53 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C01 | Min | -12.58 | -6.39 | -1.20 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C01 | Max | 13.08 | 5.85 | -0.53 | 0.00011 | -0.00014 | 0.00035 |
| 601 | C01 | Min | -13.04 | -5.84 | -1.19 | -0.00001 | -0.00032 | -0.00035 |
| 701 | C01 | Max | 0.08 | 5.85 | -0.53 | 0.00085 | 0.00056 | 0.00065 |
| 701 | C01 | Min | -0.02 | -5.85 | -1.20 | -0.00084 | 0.00024 | -0.00066 |
| 702 | C01 | Max | 0.07 | 5.86 | -0.52 | 0.00084 | 0.00056 | 0.00065 |
| 702 | C01 | Min | -0.02 | -5.84 | -1.18 | -0.00084 | 0.00024 | -0.00065 |
| 703 | C01 | Max | 0.00 | 5.84 | -0.51 | 0.00080 | -0.00058 | 0.00083 |
| 703 | C01 | Min | -0.10 | -5.84 | -1.14 | -0.00079 | -0.00131 | -0.00084 |
| 704 | C01 | Max | 0.00 | 5.84 | -0.50 | 0.00078 | -0.00057 | 0.00082 |
| 704 | C01 | Min | -0.10 | -5.83 | -1.13 | -0.00078 | -0.00129 | -0.00083 |
| 801 | C01 | Max | 0.19 | 5.72 | 0.00 | 0.00001 | 0.00364 | 0.00047 |
| 801 | C01 | Min | 0.07 | -5.71 | -0.01 | -0.00002 | 0.00161 | -0.00047 |
| 802 | C01 | Max | 0.19 | 5.72 | -0.01 | 0.00001 | 0.00362 | 0.00030 |
| 802 | C01 | Min | 0.06 | -5.71 | -0.02 | -0.00001 | 0.00160 | -0.00028 |
| 803 | C01 | Max | 0.19 | 5.72 | 0.00 | 0.00002 | 0.00359 | 0.00047 |
| 803 | C01 | Min | 0.06 | -5.71 | -0.01 | -0.00001 | 0.00158 | -0.00046 |
| 804 | C01 | Max | -0.05 | 5.68 | 0.00 | 0.00002 | -0.00167 | 0.00089 |
| 804 | C01 | Min | -0.20 | -5.67 | -0.01 | -0.00002 | -0.00378 | -0.00089 |
| 805 | C01 | Max | -0.06 | 5.68 | -0.01 | 0.00001 | -0.00166 | 0.00034 |
| 805 | C01 | Min | -0.19 | -5.67 | -0.02 | -0.00001 | -0.00375 | -0.00036 |
| 806 | C01 | Max | -0.06 | 5.68 | 0.00 | 0.00002 | -0.00164 | 0.00090 |
| 806 | C01 | Min | -0.18 | -5.67 | -0.01 | -0.00002 | -0.00372 | -0.00092 |
| | **C01** | **MAX:** | **13.08** | **6.39** | **1.32** | **0.00085** | **0.00451** | **0.00163** |

**Case-02**

| Case-02: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C02 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C02 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C02 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C02 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C02 | Max | 0.00 | 2.36 | 0.00 | -0.00006 | 0.00341 | 0.00072 |
| 10 | C02 | Min | 0.00 | -2.36 | 0.00 | -0.00017 | -0.00010 | -0.00072 |
| 11 | C02 | Max | 0.00 | 2.36 | 0.00 | 0.00016 | 0.00324 | 0.00077 |
| 11 | C02 | Min | 0.00 | -2.35 | 0.00 | 0.00008 | 0.00007 | -0.00077 |
| 12 | C02 | Max | 0.00 | 2.36 | 0.00 | -0.00008 | 0.00308 | 0.00072 |
| 12 | C02 | Min | 0.00 | -2.36 | 0.00 | -0.00015 | 0.00019 | -0.00072 |
| 13 | C02 | Max | 0.00 | 2.37 | 0.00 | 0.00014 | 0.00324 | 0.00065 |
| 13 | C02 | Min | 0.00 | -2.35 | 0.00 | 0.00008 | 0.00001 | -0.00065 |
| 14 | C02 | Max | 0.10 | 3.58 | 0.00 | -0.00022 | -0.00172 | 0.00146 |
| 14 | C02 | Min | -0.08 | -3.58 | 0.00 | -0.00038 | -0.00267 | -0.00145 |
| 15 | C02 | Max | 0.06 | 3.59 | 0.00 | 0.00038 | -0.00172 | 0.00145 |
| 15 | C02 | Min | -0.05 | -3.58 | 0.00 | 0.00023 | -0.00267 | -0.00144 |
| 16 | C02 | Max | 0.07 | 3.58 | 0.00 | -0.00023 | -0.00167 | 0.00143 |
| 16 | C02 | Min | -0.06 | -3.59 | 0.00 | -0.00036 | -0.00266 | -0.00146 |
| 17 | C02 | Max | 0.09 | 3.59 | 0.00 | 0.00036 | -0.00167 | 0.00143 |
| 17 | C02 | Min | -0.08 | -3.58 | 0.00 | 0.00023 | -0.00266 | -0.00146 |
| 21 | C02 | Max | 0.06 | 2.36 | 0.00 | -0.00006 | 0.00341 | 0.00072 |
| 21 | C02 | Min | 0.00 | -2.35 | 0.00 | -0.00017 | -0.00010 | -0.00072 |
| 22 | C02 | Max | 0.05 | 2.36 | 0.00 | 0.00016 | 0.00323 | 0.00077 |
| 22 | C02 | Min | 0.00 | -2.35 | 0.00 | 0.00008 | 0.00007 | -0.00077 |
| 23 | C02 | Max | 0.05 | 2.36 | 0.00 | -0.00008 | 0.00307 | 0.00072 |
| 23 | C02 | Min | 0.00 | -2.36 | 0.00 | -0.00015 | 0.00019 | -0.00072 |
| 24 | C02 | Max | 0.05 | 2.36 | 0.00 | 0.00014 | 0.00324 | 0.00065 |
| 24 | C02 | Min | 0.00 | -2.36 | 0.00 | 0.00008 | 0.00001 | -0.00065 |
| 25 | C02 | Max | 0.06 | 3.59 | 0.00 | -0.00022 | -0.00172 | 0.00146 |
| 25 | C02 | Min | -0.12 | -3.58 | 0.00 | -0.00038 | -0.00267 | -0.00145 |
| 26 | C02 | Max | 0.03 | 3.59 | 0.00 | 0.00038 | -0.00172 | 0.00145 |
| 26 | C02 | Min | -0.09 | -3.58 | 0.00 | 0.00023 | -0.00267 | -0.00144 |
| 27 | C02 | Max | 0.03 | 3.59 | 0.00 | -0.00023 | -0.00167 | 0.00143 |
| 27 | C02 | Min | -0.09 | -3.58 | 0.00 | -0.00036 | -0.00266 | -0.00146 |
| 28 | C02 | Max | 0.06 | 3.59 | 0.00 | 0.00036 | -0.00167 | 0.00143 |
| 28 | C02 | Min | -0.11 | -3.58 | 0.00 | 0.00023 | -0.00266 | -0.00146 |
| 100 | C02 | Max | 0.07 | 2.36 | 0.00 | 0.00001 | 0.00202 | 0.00056 |
| 100 | C02 | Min | -0.02 | -2.35 | 0.00 | -0.00001 | 0.00129 | -0.00056 |
| 101 | C02 | Max | 0.04 | 2.36 | 0.00 | 0.00001 | 0.00202 | 0.00057 |
| 101 | C02 | Min | -0.04 | -2.35 | 0.00 | -0.00001 | 0.00129 | -0.00057 |
| 102 | C02 | Max | 0.05 | 2.44 | -0.19 | 0.00009 | 0.00186 | 0.00184 |
| 102 | C02 | Min | -0.04 | -2.44 | -0.29 | -0.00009 | 0.00119 | -0.00184 |
| 103 | C02 | Max | 0.05 | 2.60 | -0.33 | 0.00017 | 0.00143 | 0.00265 |
| 103 | C02 | Min | -0.05 | -2.60 | -0.52 | -0.00017 | 0.00091 | -0.00265 |
| 104 | C02 | Max | 0.05 | 2.87 | -0.45 | 0.00027 | 0.00054 | 0.00333 |
| 104 | C02 | Min | -0.05 | -2.86 | -0.70 | -0.00027 | 0.00035 | -0.00334 |

| Case-02: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C02 | Max | 0.05 | 2.93 | -0.46 | 0.00029 | 0.00032 | 0.00340 |
| 105 | C02 | Min | -0.05 | -2.93 | -0.71 | -0.00029 | 0.00020 | -0.00341 |
| 106 | C02 | Max | 0.06 | 3.16 | -0.44 | 0.00037 | -0.00042 | 0.00332 |
| 106 | C02 | Min | -0.05 | -3.16 | -0.69 | -0.00036 | -0.00066 | -0.00333 |
| 107 | C02 | Max | 0.06 | 3.27 | -0.40 | 0.00041 | -0.00080 | 0.00309 |
| 107 | C02 | Min | -0.05 | -3.26 | -0.62 | -0.00041 | -0.00125 | -0.00310 |
| 108 | C02 | Max | 0.06 | 3.44 | -0.23 | 0.00028 | -0.00146 | 0.00255 |
| 108 | C02 | Min | -0.05 | -3.44 | -0.36 | -0.00027 | -0.00227 | -0.00254 |
| 109 | C02 | Max | 0.06 | 3.59 | -0.01 | 0.00002 | -0.00172 | 0.00146 |
| 109 | C02 | Min | -0.05 | -3.58 | -0.01 | -0.00002 | -0.00267 | -0.00145 |
| 110 | C02 | Max | 0.02 | 3.59 | -0.01 | 0.00002 | -0.00172 | 0.00145 |
| 110 | C02 | Min | -0.09 | -3.58 | -0.01 | -0.00002 | -0.00267 | -0.00144 |
| 200 | C02 | Max | 0.06 | 2.36 | 0.00 | 0.00002 | 0.00199 | 0.00056 |
| 200 | C02 | Min | -0.01 | -2.36 | 0.00 | -0.00002 | 0.00127 | -0.00056 |
| 201 | C02 | Max | 0.04 | 2.36 | 0.00 | 0.00002 | 0.00200 | 0.00057 |
| 201 | C02 | Min | -0.03 | -2.36 | 0.00 | -0.00002 | 0.00127 | -0.00057 |
| 202 | C02 | Max | 0.04 | 2.44 | -0.18 | 0.00010 | 0.00184 | 0.00184 |
| 202 | C02 | Min | -0.04 | -2.44 | -0.29 | -0.00010 | 0.00116 | -0.00183 |
| 203 | C02 | Max | 0.04 | 2.60 | -0.33 | 0.00018 | 0.00142 | 0.00264 |
| 203 | C02 | Min | -0.04 | -2.60 | -0.51 | -0.00018 | 0.00089 | -0.00263 |
| 204 | C02 | Max | 0.05 | 2.87 | -0.44 | 0.00029 | 0.00054 | 0.00332 |
| 204 | C02 | Min | -0.04 | -2.86 | -0.69 | -0.00029 | 0.00034 | -0.00332 |
| 205 | C02 | Max | 0.05 | 2.93 | -0.45 | 0.00031 | 0.00032 | 0.00338 |
| 205 | C02 | Min | -0.04 | -2.92 | -0.71 | -0.00031 | 0.00020 | -0.00338 |
| 206 | C02 | Max | 0.05 | 3.17 | -0.43 | 0.00040 | -0.00041 | 0.00331 |
| 206 | C02 | Min | -0.04 | -3.16 | -0.69 | -0.00040 | -0.00065 | -0.00330 |
| 207 | C02 | Max | 0.05 | 3.27 | -0.39 | 0.00044 | -0.00078 | 0.00307 |
| 207 | C02 | Min | -0.05 | -3.26 | -0.62 | -0.00044 | -0.00124 | -0.00307 |
| 208 | C02 | Max | 0.05 | 3.44 | -0.23 | 0.00025 | -0.00143 | 0.00253 |
| 208 | C02 | Min | -0.05 | -3.43 | -0.36 | -0.00026 | -0.00226 | -0.00255 |
| 209 | C02 | Max | 0.05 | 3.59 | -0.01 | 0.00002 | -0.00167 | 0.00144 |
| 209 | C02 | Min | -0.05 | -3.58 | -0.01 | -0.00001 | -0.00266 | -0.00147 |
| 210 | C02 | Max | 0.02 | 3.59 | -0.01 | 0.00002 | -0.00167 | 0.00143 |
| 210 | C02 | Min | -0.08 | -3.58 | -0.01 | -0.00001 | -0.00266 | -0.00146 |
| 301 | C02 | Max | 11.97 | 3.28 | -0.40 | 0.00003 | -0.00109 | 0.00286 |
| 301 | C02 | Min | -12.15 | -3.28 | -0.62 | -0.00012 | -0.00172 | -0.00286 |
| 302 | C02 | Max | 11.99 | 3.28 | -0.39 | 0.00017 | -0.00109 | 0.00286 |
| 302 | C02 | Min | -12.16 | -3.28 | -0.62 | 0.00001 | -0.00172 | -0.00286 |
| 303 | C02 | Max | 11.97 | 3.45 | -0.23 | -0.00001 | -0.00117 | 0.00286 |
| 303 | C02 | Min | -12.15 | -3.44 | -0.36 | -0.00011 | -0.00184 | -0.00286 |
| 304 | C02 | Max | 11.99 | 3.45 | -0.23 | 0.00014 | -0.00117 | 0.00286 |
| 304 | C02 | Min | -12.16 | -3.44 | -0.36 | 0.00003 | -0.00184 | -0.00286 |
| 401 | C02 | Max | 12.00 | 3.28 | -0.40 | 0.00003 | -0.00109 | 0.00286 |
| 401 | C02 | Min | -12.11 | -3.28 | -0.62 | -0.00012 | -0.00172 | -0.00286 |
| 402 | C02 | Max | 12.02 | 3.29 | -0.39 | 0.00017 | -0.00109 | 0.00286 |
| 402 | C02 | Min | -12.13 | -3.27 | -0.62 | 0.00001 | -0.00172 | -0.00286 |
| 500 | C02 | Max | 11.95 | 4.08 | -0.40 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C02 | Min | -12.13 | -4.08 | -0.63 | 0.00000 | 0.00000 | 0.00000 |

| Case-02: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C02 | Max | 11.97 | 3.36 | -0.32 | 0.00007 | -0.00114 | 0.00286 |
| 501 | C02 | Min | -12.15 | -3.35 | -0.50 | -0.00004 | -0.00178 | -0.00286 |
| 600 | C02 | Max | 11.88 | 3.74 | -0.38 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C02 | Min | -12.06 | -3.74 | -0.60 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C02 | Max | 11.97 | 3.30 | -0.38 | 0.00010 | -0.00110 | 0.00286 |
| 601 | C02 | Min | -12.15 | -3.30 | -0.59 | -0.00005 | -0.00173 | -0.00286 |
| 701 | C02 | Max | 0.00 | 3.28 | -0.40 | 0.00041 | -0.00079 | 0.00309 |
| 701 | C02 | Min | -0.11 | -3.28 | -0.62 | -0.00041 | -0.00125 | -0.00310 |
| 702 | C02 | Max | -0.01 | 3.29 | -0.39 | 0.00044 | -0.00078 | 0.00307 |
| 702 | C02 | Min | -0.10 | -3.27 | -0.62 | -0.00044 | -0.00124 | -0.00307 |
| 703 | C02 | Max | -0.05 | 3.45 | -0.23 | 0.00028 | -0.00146 | 0.00255 |
| 703 | C02 | Min | -0.16 | -3.44 | -0.36 | -0.00027 | -0.00227 | -0.00254 |
| 704 | C02 | Max | -0.05 | 3.45 | -0.23 | 0.00025 | -0.00143 | 0.00253 |
| 704 | C02 | Min | -0.15 | -3.44 | -0.36 | -0.00026 | -0.00226 | -0.00255 |
| 801 | C02 | Max | 0.13 | 2.36 | 0.00 | 0.00001 | 0.00202 | 0.00055 |
| 801 | C02 | Min | 0.03 | -2.35 | 0.00 | -0.00001 | 0.00129 | -0.00055 |
| 802 | C02 | Max | 0.13 | 2.36 | -0.01 | 0.00000 | 0.00200 | 0.00019 |
| 802 | C02 | Min | 0.03 | -2.36 | -0.01 | 0.00000 | 0.00128 | -0.00018 |
| 803 | C02 | Max | 0.12 | 2.36 | 0.00 | 0.00002 | 0.00199 | 0.00055 |
| 803 | C02 | Min | 0.04 | -2.36 | 0.00 | -0.00002 | 0.00127 | -0.00055 |
| 804 | C02 | Max | -0.04 | 3.59 | -0.01 | 0.00002 | -0.00172 | 0.00143 |
| 804 | C02 | Min | -0.16 | -3.58 | -0.01 | -0.00002 | -0.00267 | -0.00142 |
| 805 | C02 | Max | -0.05 | 3.59 | -0.01 | 0.00001 | -0.00170 | 0.00043 |
| 805 | C02 | Min | -0.15 | -3.58 | -0.02 | -0.00001 | -0.00266 | -0.00045 |
| 806 | C02 | Max | -0.05 | 3.59 | -0.01 | 0.00002 | -0.00167 | 0.00141 |
| 806 | C02 | Min | -0.15 | -3.58 | -0.01 | -0.00001 | -0.00266 | -0.00144 |
| | **C02** | **MAX:** | **12.16** | **4.08** | **0.71** | **0.00044** | **0.00341** | **0.00341** |

## Case-03

| Case-03: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C03 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C03 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C03 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C03 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C03 | Max | 0.00 | 2.71 | 0.00 | -0.00003 | 0.00254 | 0.00073 |
| 10 | C03 | Min | 0.00 | -2.70 | 0.00 | -0.00012 | -0.00082 | -0.00072 |
| 11 | C03 | Max | 0.00 | 2.71 | 0.00 | 0.00011 | 0.00235 | 0.00078 |
| 11 | C03 | Min | 0.00 | -2.70 | 0.00 | 0.00004 | -0.00063 | -0.00078 |
| 12 | C03 | Max | 0.00 | 2.71 | 0.00 | -0.00005 | 0.00218 | 0.00070 |
| 12 | C03 | Min | 0.00 | -2.70 | 0.00 | -0.00009 | -0.00050 | -0.00069 |
| 13 | C03 | Max | 0.00 | 2.71 | 0.00 | 0.00008 | 0.00234 | 0.00065 |
| 13 | C03 | Min | 0.00 | -2.70 | 0.00 | 0.00005 | -0.00068 | -0.00065 |
| 14 | C03 | Max | 0.09 | 3.80 | 0.00 | -0.00028 | -0.00093 | 0.00141 |
| 14 | C03 | Min | -0.09 | -3.81 | 0.00 | -0.00042 | -0.00134 | -0.00141 |
| 15 | C03 | Max | 0.06 | 3.82 | 0.00 | 0.00042 | -0.00093 | 0.00139 |
| 15 | C03 | Min | -0.06 | -3.80 | 0.00 | 0.00028 | -0.00134 | -0.00139 |
| 16 | C03 | Max | 0.06 | 3.81 | 0.00 | -0.00028 | -0.00091 | 0.00141 |
| 16 | C03 | Min | -0.06 | -3.81 | 0.00 | -0.00040 | -0.00133 | -0.00141 |
| 17 | C03 | Max | 0.08 | 3.82 | 0.00 | 0.00041 | -0.00091 | 0.00139 |
| 17 | C03 | Min | -0.08 | -3.79 | 0.00 | 0.00028 | -0.00133 | -0.00140 |
| 21 | C03 | Max | 0.04 | 2.71 | 0.00 | -0.00003 | 0.00254 | 0.00073 |
| 21 | C03 | Min | -0.01 | -2.70 | 0.00 | -0.00012 | -0.00082 | -0.00072 |
| 22 | C03 | Max | 0.04 | 2.71 | 0.00 | 0.00011 | 0.00235 | 0.00078 |
| 22 | C03 | Min | -0.01 | -2.70 | 0.00 | 0.00004 | -0.00063 | -0.00078 |
| 23 | C03 | Max | 0.04 | 2.71 | 0.00 | -0.00005 | 0.00218 | 0.00070 |
| 23 | C03 | Min | -0.01 | -2.70 | 0.00 | -0.00009 | -0.00050 | -0.00069 |
| 24 | C03 | Max | 0.04 | 2.71 | 0.00 | 0.00008 | 0.00234 | 0.00065 |
| 24 | C03 | Min | -0.01 | -2.70 | 0.00 | 0.00005 | -0.00068 | -0.00065 |
| 25 | C03 | Max | 0.07 | 3.81 | 0.00 | -0.00028 | -0.00093 | 0.00141 |
| 25 | C03 | Min | -0.10 | -3.80 | 0.00 | -0.00042 | -0.00134 | -0.00141 |
| 26 | C03 | Max | 0.04 | 3.81 | 0.00 | 0.00042 | -0.00093 | 0.00139 |
| 26 | C03 | Min | -0.08 | -3.80 | 0.00 | 0.00028 | -0.00134 | -0.00139 |
| 27 | C03 | Max | 0.05 | 3.81 | 0.00 | -0.00028 | -0.00091 | 0.00141 |
| 27 | C03 | Min | -0.08 | -3.80 | 0.00 | -0.00040 | -0.00133 | -0.00141 |
| 28 | C03 | Max | 0.07 | 3.81 | 0.00 | 0.00041 | -0.00091 | 0.00139 |
| 28 | C03 | Min | -0.10 | -3.80 | 0.00 | 0.00028 | -0.00133 | -0.00140 |
| 100 | C03 | Max | 0.06 | 2.71 | 0.00 | 0.00000 | 0.00102 | 0.00052 |
| 100 | C03 | Min | -0.03 | -2.70 | 0.00 | -0.00001 | 0.00070 | -0.00052 |
| 101 | C03 | Max | 0.04 | 2.71 | 0.00 | 0.00001 | 0.00102 | 0.00053 |
| 101 | C03 | Min | -0.04 | -2.70 | 0.00 | -0.00001 | 0.00070 | -0.00053 |
| 102 | C03 | Max | 0.05 | 2.78 | -0.10 | 0.00005 | 0.00093 | 0.00168 |
| 102 | C03 | Min | -0.04 | -2.78 | -0.15 | -0.00005 | 0.00063 | -0.00168 |
| 103 | C03 | Max | 0.05 | 2.92 | -0.18 | 0.00008 | 0.00070 | 0.00245 |
| 103 | C03 | Min | -0.05 | -2.91 | -0.26 | -0.00008 | 0.00048 | -0.00245 |
| 104 | C03 | Max | 0.05 | 3.15 | -0.24 | 0.00013 | 0.00025 | 0.00308 |
| 104 | C03 | Min | -0.05 | -3.14 | -0.34 | -0.00013 | 0.00017 | -0.00308 |
| 105 | C03 | Max | 0.05 | 3.19 | -0.24 | 0.00015 | 0.00014 | 0.00315 |

| Case-03: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C03 | Min | -0.05 | -3.19 | -0.35 | -0.00014 | 0.00009 | -0.00315 |
| 106 | C03 | Max | 0.06 | 3.37 | -0.23 | 0.00018 | -0.00019 | 0.00318 |
| 106 | C03 | Min | -0.05 | -3.36 | -0.34 | -0.00018 | -0.00030 | -0.00318 |
| 107 | C03 | Max | 0.06 | 3.48 | -0.21 | 0.00021 | -0.00039 | 0.00310 |
| 107 | C03 | Min | -0.05 | -3.47 | -0.31 | -0.00020 | -0.00058 | -0.00310 |
| 108 | C03 | Max | 0.06 | 3.65 | -0.13 | 0.00024 | -0.00074 | 0.00258 |
| 108 | C03 | Min | -0.06 | -3.64 | -0.19 | -0.00024 | -0.00108 | -0.00258 |
| 109 | C03 | Max | 0.06 | 3.81 | -0.01 | 0.00002 | -0.00093 | 0.00141 |
| 109 | C03 | Min | -0.06 | -3.80 | -0.01 | -0.00002 | -0.00134 | -0.00141 |
| 110 | C03 | Max | 0.04 | 3.81 | -0.01 | 0.00002 | -0.00093 | 0.00140 |
| 110 | C03 | Min | -0.07 | -3.80 | -0.01 | -0.00002 | -0.00134 | -0.00140 |
| 200 | C03 | Max | 0.05 | 2.71 | 0.00 | 0.00002 | 0.00099 | 0.00052 |
| 200 | C03 | Min | -0.02 | -2.70 | 0.00 | -0.00001 | 0.00068 | -0.00052 |
| 201 | C03 | Max | 0.04 | 2.71 | 0.00 | 0.00002 | 0.00099 | 0.00053 |
| 201 | C03 | Min | -0.04 | -2.70 | 0.00 | -0.00001 | 0.00068 | -0.00052 |
| 202 | C03 | Max | 0.04 | 2.78 | -0.10 | 0.00005 | 0.00091 | 0.00172 |
| 202 | C03 | Min | -0.04 | -2.77 | -0.14 | -0.00005 | 0.00062 | -0.00171 |
| 203 | C03 | Max | 0.04 | 2.91 | -0.17 | 0.00009 | 0.00068 | 0.00248 |
| 203 | C03 | Min | -0.04 | -2.90 | -0.25 | -0.00009 | 0.00047 | -0.00247 |
| 204 | C03 | Max | 0.05 | 3.13 | -0.23 | 0.00014 | 0.00025 | 0.00306 |
| 204 | C03 | Min | -0.04 | -3.12 | -0.34 | -0.00014 | 0.00017 | -0.00305 |
| 205 | C03 | Max | 0.05 | 3.18 | -0.23 | 0.00015 | 0.00014 | 0.00312 |
| 205 | C03 | Min | -0.05 | -3.16 | -0.34 | -0.00015 | 0.00009 | -0.00311 |
| 206 | C03 | Max | 0.05 | 3.35 | -0.23 | 0.00019 | -0.00019 | 0.00315 |
| 206 | C03 | Min | -0.05 | -3.33 | -0.34 | -0.00019 | -0.00028 | -0.00314 |
| 207 | C03 | Max | 0.05 | 3.46 | -0.21 | 0.00021 | -0.00038 | 0.00302 |
| 207 | C03 | Min | -0.05 | -3.45 | -0.30 | -0.00021 | -0.00056 | -0.00302 |
| 208 | C03 | Max | 0.05 | 3.65 | -0.13 | 0.00025 | -0.00072 | 0.00252 |
| 208 | C03 | Min | -0.05 | -3.64 | -0.19 | -0.00025 | -0.00106 | -0.00253 |
| 209 | C03 | Max | 0.05 | 3.81 | -0.01 | 0.00001 | -0.00091 | 0.00141 |
| 209 | C03 | Min | -0.05 | -3.80 | -0.01 | -0.00002 | -0.00133 | -0.00142 |
| 210 | C03 | Max | 0.04 | 3.81 | -0.01 | 0.00001 | -0.00091 | 0.00140 |
| 210 | C03 | Min | -0.07 | -3.80 | -0.01 | -0.00001 | -0.00133 | -0.00141 |
| 301 | C03 | Max | 12.47 | 3.65 | -0.13 | -0.00003 | -0.00081 | 0.00204 |
| 301 | C03 | Min | -12.61 | -3.64 | -0.19 | -0.00009 | -0.00119 | -0.00204 |
| 302 | C03 | Max | 12.49 | 3.65 | -0.13 | 0.00011 | -0.00081 | 0.00204 |
| 302 | C03 | Min | -12.64 | -3.64 | -0.19 | 0.00005 | -0.00118 | -0.00204 |
| 303 | C03 | Max | 12.47 | 3.81 | -0.01 | -0.00005 | -0.00090 | 0.00205 |
| 303 | C03 | Min | -12.61 | -3.80 | -0.01 | -0.00008 | -0.00130 | -0.00203 |
| 304 | C03 | Max | 12.49 | 3.81 | -0.01 | 0.00008 | -0.00089 | 0.00203 |
| 304 | C03 | Min | -12.64 | -3.80 | -0.01 | 0.00006 | -0.00130 | -0.00204 |
| 401 | C03 | Max | 12.49 | 3.65 | -0.13 | -0.00003 | -0.00081 | 0.00204 |
| 401 | C03 | Min | -12.59 | -3.65 | -0.19 | -0.00009 | -0.00119 | -0.00204 |
| 402 | C03 | Max | 12.51 | 3.66 | -0.13 | 0.00011 | -0.00081 | 0.00204 |
| 402 | C03 | Min | -12.61 | -3.64 | -0.19 | 0.00005 | -0.00118 | -0.00204 |
| 500 | C03 | Max | 12.14 | 4.08 | -0.16 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C03 | Min | -12.29 | -4.07 | -0.23 | 0.00000 | 0.00000 | 0.00000 |
| 501 | C03 | Max | 12.48 | 3.73 | -0.08 | 0.00001 | -0.00085 | 0.00204 |

| Case-03: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C03 | Min | -12.62 | -3.72 | -0.11 | 0.00000 | -0.00125 | -0.00204 |
| 600 | C03 | Max | 12.06 | 3.91 | -0.12 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C03 | Min | -12.21 | -3.90 | -0.18 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C03 | Max | 12.48 | 3.67 | -0.12 | 0.00003 | -0.00082 | 0.00204 |
| 601 | C03 | Min | -12.62 | -3.66 | -0.18 | -0.00002 | -0.00120 | -0.00204 |
| 701 | C03 | Max | 0.01 | 3.65 | -0.13 | 0.00025 | -0.00074 | 0.00258 |
| 701 | C03 | Min | -0.11 | -3.65 | -0.19 | -0.00024 | -0.00108 | -0.00258 |
| 702 | C03 | Max | 0.00 | 3.66 | -0.13 | 0.00025 | -0.00072 | 0.00252 |
| 702 | C03 | Min | -0.10 | -3.64 | -0.19 | -0.00025 | -0.00106 | -0.00253 |
| 703 | C03 | Max | 0.00 | 3.81 | -0.01 | 0.00003 | -0.00093 | 0.00141 |
| 703 | C03 | Min | -0.12 | -3.80 | -0.01 | -0.00002 | -0.00134 | -0.00141 |
| 704 | C03 | Max | -0.01 | 3.81 | -0.01 | 0.00001 | -0.00091 | 0.00141 |
| 704 | C03 | Min | -0.11 | -3.80 | -0.01 | -0.00002 | -0.00133 | -0.00142 |
| 801 | C03 | Max | 0.09 | 2.71 | 0.00 | 0.00001 | 0.00102 | 0.00051 |
| 801 | C03 | Min | 0.00 | -2.70 | 0.00 | -0.00001 | 0.00070 | -0.00051 |
| 802 | C03 | Max | 0.08 | 2.71 | -0.01 | 0.00000 | 0.00101 | 0.00015 |
| 802 | C03 | Min | 0.00 | -2.70 | -0.01 | 0.00000 | 0.00069 | -0.00014 |
| 803 | C03 | Max | 0.08 | 2.71 | 0.00 | 0.00002 | 0.00099 | 0.00051 |
| 803 | C03 | Min | 0.00 | -2.70 | 0.00 | -0.00001 | 0.00068 | -0.00051 |
| 804 | C03 | Max | 0.01 | 3.81 | -0.01 | 0.00002 | -0.00093 | 0.00138 |
| 804 | C03 | Min | -0.11 | -3.80 | -0.01 | -0.00002 | -0.00134 | -0.00138 |
| 805 | C03 | Max | 0.00 | 3.81 | -0.01 | 0.00001 | -0.00092 | 0.00044 |
| 805 | C03 | Min | -0.11 | -3.80 | -0.02 | -0.00001 | -0.00133 | -0.00045 |
| 806 | C03 | Max | 0.00 | 3.81 | -0.01 | 0.00001 | -0.00090 | 0.00138 |
| 806 | C03 | Min | -0.10 | -3.80 | -0.01 | -0.00001 | -0.00133 | -0.00139 |
| | **C03** | **MAX:** | **12.64** | **4.08** | **0.35** | **0.00042** | **0.00254** | **0.00318** |

**Case-04**

| Case-04: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C04 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C04 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C04 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C04 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C04 | Max | 0.00 | 5.40 | 0.00 | -0.00005 | 0.00254 | 0.00075 |
| 10 | C04 | Min | 0.00 | -5.40 | 0.00 | -0.00014 | -0.00036 | -0.00074 |
| 11 | C04 | Max | 0.00 | 5.41 | 0.00 | 0.00013 | 0.00270 | 0.00069 |
| 11 | C04 | Min | 0.00 | -5.40 | 0.00 | 0.00006 | -0.00054 | -0.00069 |
| 12 | C04 | Max | 0.00 | 5.40 | 0.00 | -0.00007 | 0.00251 | 0.00065 |
| 12 | C04 | Min | 0.00 | -5.40 | 0.00 | -0.00011 | -0.00041 | -0.00064 |
| 13 | C04 | Max | 0.00 | 5.41 | 0.00 | 0.00011 | 0.00248 | 0.00065 |
| 13 | C04 | Min | 0.00 | -5.40 | 0.00 | 0.00007 | -0.00040 | -0.00065 |
| 14 | C04 | Max | 0.08 | 5.36 | 0.00 | -0.00005 | -0.00091 | 0.00096 |
| 14 | C04 | Min | -0.07 | -5.36 | 0.00 | -0.00015 | -0.00131 | -0.00098 |
| 15 | C04 | Max | 0.06 | 5.36 | 0.00 | 0.00014 | -0.00091 | 0.00096 |
| 15 | C04 | Min | -0.06 | -5.36 | 0.00 | 0.00007 | -0.00131 | -0.00097 |
| 16 | C04 | Max | 0.06 | 5.36 | 0.00 | -0.00008 | -0.00087 | 0.00096 |
| 16 | C04 | Min | -0.06 | -5.36 | 0.00 | -0.00012 | -0.00126 | -0.00098 |
| 17 | C04 | Max | 0.07 | 5.37 | 0.00 | 0.00012 | -0.00087 | 0.00096 |
| 17 | C04 | Min | -0.06 | -5.36 | 0.00 | 0.00007 | -0.00126 | -0.00098 |
| 21 | C04 | Max | 0.04 | 5.40 | 0.00 | -0.00005 | 0.00254 | 0.00075 |
| 21 | C04 | Min | -0.01 | -5.40 | 0.00 | -0.00014 | -0.00036 | -0.00074 |
| 22 | C04 | Max | 0.04 | 5.40 | 0.00 | 0.00013 | 0.00270 | 0.00069 |
| 22 | C04 | Min | -0.01 | -5.40 | 0.00 | 0.00006 | -0.00054 | -0.00069 |
| 23 | C04 | Max | 0.04 | 5.41 | 0.00 | -0.00007 | 0.00251 | 0.00065 |
| 23 | C04 | Min | -0.01 | -5.40 | 0.00 | -0.00011 | -0.00041 | -0.00064 |
| 24 | C04 | Max | 0.04 | 5.41 | 0.00 | 0.00011 | 0.00248 | 0.00065 |
| 24 | C04 | Min | -0.01 | -5.40 | 0.00 | 0.00007 | -0.00040 | -0.00065 |
| 25 | C04 | Max | 0.06 | 5.36 | 0.00 | -0.00005 | -0.00091 | 0.00096 |
| 25 | C04 | Min | -0.09 | -5.36 | 0.00 | -0.00015 | -0.00131 | -0.00098 |
| 26 | C04 | Max | 0.04 | 5.36 | 0.00 | 0.00014 | -0.00091 | 0.00096 |
| 26 | C04 | Min | -0.07 | -5.36 | 0.00 | 0.00007 | -0.00131 | -0.00097 |
| 27 | C04 | Max | 0.05 | 5.36 | 0.00 | -0.00008 | -0.00087 | 0.00096 |
| 27 | C04 | Min | -0.08 | -5.36 | 0.00 | -0.00012 | -0.00126 | -0.00098 |
| 28 | C04 | Max | 0.05 | 5.36 | 0.00 | 0.00012 | -0.00087 | 0.00096 |
| 28 | C04 | Min | -0.08 | -5.36 | 0.00 | 0.00007 | -0.00126 | -0.00098 |
| 100 | C04 | Max | 0.06 | 5.40 | 0.00 | 0.00002 | 0.00128 | 0.00050 |
| 100 | C04 | Min | -0.02 | -5.40 | 0.00 | -0.00002 | 0.00089 | -0.00049 |
| 101 | C04 | Max | 0.04 | 5.40 | 0.00 | 0.00002 | 0.00128 | 0.00051 |
| 101 | C04 | Min | -0.04 | -5.40 | 0.00 | -0.00002 | 0.00089 | -0.00050 |
| 102 | C04 | Max | 0.05 | 5.44 | -0.13 | 0.00030 | 0.00116 | 0.00155 |
| 102 | C04 | Min | -0.04 | -5.44 | -0.18 | -0.00030 | 0.00081 | -0.00155 |
| 103 | C04 | Max | 0.05 | 5.50 | -0.22 | 0.00056 | 0.00083 | 0.00169 |
| 103 | C04 | Min | -0.04 | -5.49 | -0.32 | -0.00056 | 0.00058 | -0.00169 |
| 104 | C04 | Max | 0.05 | 5.55 | -0.29 | 0.00090 | 0.00018 | 0.00065 |
| 104 | C04 | Min | -0.05 | -5.55 | -0.41 | -0.00090 | 0.00012 | -0.00065 |

| Case-04: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C04 | Max | 0.05 | 5.56 | -0.29 | 0.00089 | 0.00003 | 0.00033 |
| 105 | C04 | Min | -0.05 | -5.55 | -0.42 | -0.00089 | 0.00000 | -0.00033 |
| 106 | C04 | Max | 0.05 | 5.53 | -0.27 | 0.00085 | -0.00031 | 0.00085 |
| 106 | C04 | Min | -0.05 | -5.53 | -0.39 | -0.00085 | -0.00045 | -0.00085 |
| 107 | C04 | Max | 0.05 | 5.49 | -0.23 | 0.00063 | -0.00058 | 0.00148 |
| 107 | C04 | Min | -0.05 | -5.49 | -0.33 | -0.00063 | -0.00083 | -0.00149 |
| 108 | C04 | Max | 0.06 | 5.42 | -0.13 | 0.00033 | -0.00082 | 0.00164 |
| 108 | C04 | Min | -0.05 | -5.42 | -0.19 | -0.00033 | -0.00118 | -0.00164 |
| 109 | C04 | Max | 0.06 | 5.36 | 0.00 | 0.00002 | -0.00091 | 0.00097 |
| 109 | C04 | Min | -0.05 | -5.36 | 0.00 | -0.00002 | -0.00131 | -0.00098 |
| 110 | C04 | Max | 0.04 | 5.36 | 0.00 | 0.00002 | -0.00091 | 0.00096 |
| 110 | C04 | Min | -0.07 | -5.36 | 0.00 | -0.00002 | -0.00131 | -0.00097 |
| 200 | C04 | Max | 0.05 | 5.41 | 0.00 | 0.00002 | 0.00124 | 0.00049 |
| 200 | C04 | Min | -0.02 | -5.40 | 0.00 | -0.00001 | 0.00085 | -0.00049 |
| 201 | C04 | Max | 0.04 | 5.41 | 0.00 | 0.00002 | 0.00124 | 0.00050 |
| 201 | C04 | Min | -0.03 | -5.40 | 0.00 | -0.00001 | 0.00085 | -0.00050 |
| 202 | C04 | Max | 0.04 | 5.44 | -0.12 | 0.00030 | 0.00112 | 0.00154 |
| 202 | C04 | Min | -0.04 | -5.44 | -0.18 | -0.00029 | 0.00077 | -0.00153 |
| 203 | C04 | Max | 0.04 | 5.50 | -0.21 | 0.00057 | 0.00081 | 0.00169 |
| 203 | C04 | Min | -0.04 | -5.49 | -0.31 | -0.00056 | 0.00055 | -0.00168 |
| 204 | C04 | Max | 0.05 | 5.56 | -0.28 | 0.00091 | 0.00018 | 0.00064 |
| 204 | C04 | Min | -0.04 | -5.55 | -0.40 | -0.00090 | 0.00011 | -0.00065 |
| 205 | C04 | Max | 0.05 | 5.56 | -0.28 | 0.00089 | 0.00003 | 0.00033 |
| 205 | C04 | Min | -0.04 | -5.55 | -0.40 | -0.00089 | -0.00001 | -0.00033 |
| 206 | C04 | Max | 0.05 | 5.54 | -0.26 | 0.00085 | -0.00030 | 0.00084 |
| 206 | C04 | Min | -0.04 | -5.53 | -0.38 | -0.00085 | -0.00044 | -0.00085 |
| 207 | C04 | Max | 0.05 | 5.49 | -0.22 | 0.00063 | -0.00055 | 0.00147 |
| 207 | C04 | Min | -0.04 | -5.49 | -0.32 | -0.00063 | -0.00080 | -0.00148 |
| 208 | C04 | Max | 0.05 | 5.42 | -0.12 | 0.00033 | -0.00078 | 0.00163 |
| 208 | C04 | Min | -0.05 | -5.42 | -0.18 | -0.00033 | -0.00114 | -0.00164 |
| 209 | C04 | Max | 0.05 | 5.36 | 0.00 | 0.00002 | -0.00087 | 0.00097 |
| 209 | C04 | Min | -0.05 | -5.36 | 0.00 | -0.00002 | -0.00126 | -0.00098 |
| 210 | C04 | Max | 0.03 | 5.36 | 0.00 | 0.00002 | -0.00087 | 0.00096 |
| 210 | C04 | Min | -0.06 | -5.36 | 0.00 | -0.00002 | -0.00126 | -0.00098 |
| 301 | C04 | Max | 11.92 | 5.57 | -0.29 | 0.00018 | -0.00008 | 0.00031 |
| 301 | C04 | Min | -11.91 | -5.57 | -0.41 | -0.00011 | -0.00013 | -0.00032 |
| 302 | C04 | Max | 11.92 | 5.57 | -0.28 | 0.00022 | -0.00007 | 0.00031 |
| 302 | C04 | Min | -11.90 | -5.57 | -0.40 | -0.00007 | -0.00013 | -0.00032 |
| 303 | C04 | Max | 11.92 | 5.55 | -0.27 | 0.00017 | -0.00010 | 0.00032 |
| 303 | C04 | Min | -11.91 | -5.55 | -0.39 | -0.00011 | -0.00016 | -0.00032 |
| 304 | C04 | Max | 11.92 | 5.55 | -0.26 | 0.00021 | -0.00010 | 0.00032 |
| 304 | C04 | Min | -11.90 | -5.55 | -0.38 | -0.00007 | -0.00016 | -0.00032 |
| 401 | C04 | Max | 11.93 | 5.57 | -0.29 | 0.00018 | -0.00008 | 0.00031 |
| 401 | C04 | Min | -11.91 | -5.57 | -0.41 | -0.00011 | -0.00013 | -0.00032 |
| 402 | C04 | Max | 11.92 | 5.57 | -0.28 | 0.00022 | -0.00007 | 0.00031 |
| 402 | C04 | Min | -11.90 | -5.57 | -0.40 | -0.00007 | -0.00013 | -0.00032 |
| 500 | C04 | Max | 13.46 | 8.49 | -0.28 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C04 | Min | -13.44 | -8.49 | -0.40 | 0.00000 | 0.00000 | 0.00000 |

| Case-04: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C04 | Max | 11.92 | 5.56 | -0.28 | 0.00019 | -0.00009 | 0.00032 |
| 501 | C04 | Min | -11.91 | -5.56 | -0.40 | -0.00009 | -0.00015 | -0.00032 |
| 600 | C04 | Max | 13.48 | 8.32 | -0.29 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C04 | Min | -13.46 | -8.31 | -0.41 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C04 | Max | 11.92 | 5.57 | -0.29 | 0.00020 | -0.00008 | 0.00031 |
| 601 | C04 | Min | -11.91 | -5.56 | -0.40 | -0.00009 | -0.00014 | -0.00032 |
| 701 | C04 | Max | 0.06 | 5.57 | -0.29 | 0.00090 | 0.00019 | 0.00065 |
| 701 | C04 | Min | -0.04 | -5.57 | -0.41 | -0.00090 | 0.00012 | -0.00065 |
| 702 | C04 | Max | 0.05 | 5.57 | -0.28 | 0.00091 | 0.00018 | 0.00064 |
| 702 | C04 | Min | -0.03 | -5.57 | -0.40 | -0.00091 | 0.00011 | -0.00065 |
| 703 | C04 | Max | 0.03 | 5.55 | -0.27 | 0.00085 | -0.00031 | 0.00085 |
| 703 | C04 | Min | -0.07 | -5.55 | -0.39 | -0.00085 | -0.00045 | -0.00085 |
| 704 | C04 | Max | 0.03 | 5.55 | -0.26 | 0.00085 | -0.00030 | 0.00084 |
| 704 | C04 | Min | -0.06 | -5.55 | -0.38 | -0.00085 | -0.00044 | -0.00085 |
| 801 | C04 | Max | 0.10 | 5.40 | 0.00 | 0.00002 | 0.00128 | 0.00049 |
| 801 | C04 | Min | 0.01 | -5.40 | 0.00 | -0.00002 | 0.00089 | -0.00048 |
| 802 | C04 | Max | 0.09 | 5.40 | 0.00 | 0.00001 | 0.00125 | 0.00031 |
| 802 | C04 | Min | 0.01 | -5.40 | -0.02 | -0.00001 | 0.00088 | -0.00029 |
| 803 | C04 | Max | 0.09 | 5.40 | 0.00 | 0.00002 | 0.00124 | 0.00048 |
| 803 | C04 | Min | 0.01 | -5.40 | 0.00 | -0.00001 | 0.00085 | -0.00048 |
| 804 | C04 | Max | 0.00 | 5.36 | 0.00 | 0.00002 | -0.00091 | 0.00095 |
| 804 | C04 | Min | -0.10 | -5.36 | 0.00 | -0.00002 | -0.00132 | -0.00096 |
| 805 | C04 | Max | 0.00 | 5.36 | 0.00 | 0.00001 | -0.00090 | 0.00038 |
| 805 | C04 | Min | -0.10 | -5.36 | -0.02 | -0.00001 | -0.00128 | -0.00040 |
| 806 | C04 | Max | 0.00 | 5.36 | 0.00 | 0.00002 | -0.00087 | 0.00095 |
| 806 | C04 | Min | -0.10 | -5.36 | 0.00 | -0.00002 | -0.00126 | -0.00096 |
| | **C04** | **MAX:** | **13.48** | **8.49** | **0.42** | **0.00091** | **0.00270** | **0.00169** |

## Case-05

| Case-05: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C05 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C05 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C05 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C05 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C05 | Max | 0.00 | 2.31 | 0.00 | -0.00002 | 0.00256 | 0.00073 |
| 10 | C05 | Min | 0.00 | -2.30 | 0.00 | -0.00012 | -0.00098 | -0.00073 |
| 11 | C05 | Max | 0.00 | 2.31 | 0.00 | 0.00011 | 0.00235 | 0.00081 |
| 11 | C05 | Min | 0.00 | -2.30 | 0.00 | 0.00003 | -0.00078 | -0.00081 |
| 12 | C05 | Max | 0.00 | 2.31 | 0.00 | -0.00004 | 0.00215 | 0.00068 |
| 12 | C05 | Min | 0.00 | -2.31 | 0.00 | -0.00009 | -0.00062 | -0.00068 |
| 13 | C05 | Max | 0.00 | 2.31 | 0.00 | 0.00009 | 0.00232 | 0.00065 |
| 13 | C05 | Min | 0.00 | -2.30 | 0.00 | 0.00004 | -0.00080 | -0.00065 |
| 14 | C05 | Max | 0.10 | 4.05 | 0.00 | -0.00007 | -0.00078 | 0.00143 |
| 14 | C05 | Min | -0.09 | -4.05 | 0.00 | -0.00018 | -0.00113 | -0.00143 |
| 15 | C05 | Max | 0.06 | 4.06 | 0.00 | 0.00017 | -0.00078 | 0.00142 |
| 15 | C05 | Min | -0.05 | -4.05 | 0.00 | 0.00009 | -0.00113 | -0.00142 |
| 16 | C05 | Max | 0.06 | 4.05 | 0.00 | -0.00010 | -0.00075 | 0.00141 |
| 16 | C05 | Min | -0.06 | -4.05 | 0.00 | -0.00015 | -0.00111 | -0.00143 |
| 17 | C05 | Max | 0.08 | 4.06 | 0.00 | 0.00014 | -0.00075 | 0.00141 |
| 17 | C05 | Min | -0.08 | -4.05 | 0.00 | 0.00010 | -0.00111 | -0.00142 |
| 21 | C05 | Max | 0.04 | 2.31 | 0.00 | -0.00002 | 0.00256 | 0.00073 |
| 21 | C05 | Min | -0.02 | -2.30 | 0.00 | -0.00012 | -0.00098 | -0.00073 |
| 22 | C05 | Max | 0.04 | 2.31 | 0.00 | 0.00011 | 0.00235 | 0.00081 |
| 22 | C05 | Min | -0.01 | -2.30 | 0.00 | 0.00003 | -0.00078 | -0.00081 |
| 23 | C05 | Max | 0.04 | 2.31 | 0.00 | -0.00004 | 0.00215 | 0.00068 |
| 23 | C05 | Min | -0.01 | -2.30 | 0.00 | -0.00009 | -0.00061 | -0.00068 |
| 24 | C05 | Max | 0.04 | 2.31 | 0.00 | 0.00009 | 0.00232 | 0.00065 |
| 24 | C05 | Min | -0.01 | -2.30 | 0.00 | 0.00004 | -0.00080 | -0.00065 |
| 25 | C05 | Max | 0.08 | 4.05 | 0.00 | -0.00007 | -0.00078 | 0.00143 |
| 25 | C05 | Min | -0.11 | -4.05 | 0.00 | -0.00018 | -0.00113 | -0.00143 |
| 26 | C05 | Max | 0.04 | 4.05 | 0.00 | 0.00017 | -0.00078 | 0.00142 |
| 26 | C05 | Min | -0.07 | -4.05 | 0.00 | 0.00009 | -0.00113 | -0.00142 |
| 27 | C05 | Max | 0.05 | 4.06 | 0.00 | -0.00010 | -0.00075 | 0.00141 |
| 27 | C05 | Min | -0.07 | -4.05 | 0.00 | -0.00015 | -0.00111 | -0.00143 |
| 28 | C05 | Max | 0.07 | 4.06 | 0.00 | 0.00014 | -0.00075 | 0.00141 |
| 28 | C05 | Min | -0.09 | -4.05 | 0.00 | 0.00010 | -0.00111 | -0.00142 |
| 100 | C05 | Max | 0.05 | 2.31 | 0.00 | 0.00001 | 0.00094 | 0.00053 |
| 100 | C05 | Min | -0.03 | -2.30 | 0.00 | -0.00001 | 0.00063 | -0.00053 |
| 101 | C05 | Max | 0.04 | 2.31 | 0.00 | 0.00001 | 0.00094 | 0.00054 |
| 101 | C05 | Min | -0.04 | -2.30 | 0.00 | -0.00001 | 0.00063 | -0.00054 |
| 102 | C05 | Max | 0.05 | 2.42 | -0.09 | 0.00008 | 0.00085 | 0.00178 |
| 102 | C05 | Min | -0.04 | -2.42 | -0.14 | -0.00008 | 0.00058 | -0.00178 |
| 103 | C05 | Max | 0.05 | 2.62 | -0.16 | 0.00015 | 0.00062 | 0.00262 |
| 103 | C05 | Min | -0.05 | -2.62 | -0.24 | -0.00015 | 0.00043 | -0.00262 |
| 104 | C05 | Max | 0.05 | 2.94 | -0.21 | 0.00024 | 0.00020 | 0.00329 |
| 104 | C05 | Min | -0.05 | -2.94 | -0.31 | -0.00024 | 0.00013 | -0.00329 |

| Case-05: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C05 | Max | 0.05 | 3.02 | -0.22 | 0.00026 | 0.00011 | 0.00337 |
| 105 | C05 | Min | -0.05 | -3.02 | -0.32 | -0.00026 | 0.00005 | -0.00338 |
| 106 | C05 | Max | 0.05 | 3.38 | -0.21 | 0.00033 | -0.00022 | 0.00330 |
| 106 | C05 | Min | -0.05 | -3.38 | -0.30 | -0.00033 | -0.00034 | -0.00330 |
| 107 | C05 | Max | 0.06 | 3.56 | -0.18 | 0.00037 | -0.00039 | 0.00303 |
| 107 | C05 | Min | -0.05 | -3.56 | -0.27 | -0.00037 | -0.00057 | -0.00303 |
| 108 | C05 | Max | 0.06 | 3.87 | -0.11 | 0.00025 | -0.00067 | 0.00249 |
| 108 | C05 | Min | -0.05 | -3.87 | -0.15 | -0.00025 | -0.00097 | -0.00249 |
| 109 | C05 | Max | 0.06 | 4.05 | 0.00 | 0.00002 | -0.00078 | 0.00143 |
| 109 | C05 | Min | -0.06 | -4.05 | 0.00 | -0.00002 | -0.00113 | -0.00143 |
| 110 | C05 | Max | 0.04 | 4.05 | 0.00 | 0.00001 | -0.00078 | 0.00142 |
| 110 | C05 | Min | -0.07 | -4.05 | 0.00 | -0.00002 | -0.00113 | -0.00142 |
| 200 | C05 | Max | 0.05 | 2.31 | 0.00 | 0.00002 | 0.00090 | 0.00055 |
| 200 | C05 | Min | -0.02 | -2.30 | 0.00 | -0.00001 | 0.00062 | -0.00055 |
| 201 | C05 | Max | 0.04 | 2.31 | 0.00 | 0.00002 | 0.00090 | 0.00056 |
| 201 | C05 | Min | -0.03 | -2.30 | 0.00 | -0.00001 | 0.00062 | -0.00055 |
| 202 | C05 | Max | 0.04 | 2.43 | -0.09 | 0.00010 | 0.00082 | 0.00180 |
| 202 | C05 | Min | -0.04 | -2.42 | -0.13 | -0.00009 | 0.00056 | -0.00180 |
| 203 | C05 | Max | 0.04 | 2.63 | -0.16 | 0.00018 | 0.00061 | 0.00263 |
| 203 | C05 | Min | -0.04 | -2.63 | -0.23 | -0.00017 | 0.00042 | -0.00263 |
| 204 | C05 | Max | 0.05 | 2.96 | -0.21 | 0.00028 | 0.00021 | 0.00330 |
| 204 | C05 | Min | -0.04 | -2.95 | -0.30 | -0.00027 | 0.00013 | -0.00330 |
| 205 | C05 | Max | 0.05 | 3.03 | -0.21 | 0.00030 | 0.00011 | 0.00339 |
| 205 | C05 | Min | -0.04 | -3.03 | -0.31 | -0.00029 | 0.00006 | -0.00338 |
| 206 | C05 | Max | 0.05 | 3.38 | -0.20 | 0.00038 | -0.00022 | 0.00331 |
| 206 | C05 | Min | -0.05 | -3.38 | -0.29 | -0.00037 | -0.00032 | -0.00331 |
| 207 | C05 | Max | 0.05 | 3.56 | -0.18 | 0.00042 | -0.00038 | 0.00303 |
| 207 | C05 | Min | -0.05 | -3.56 | -0.26 | -0.00042 | -0.00056 | -0.00304 |
| 208 | C05 | Max | 0.05 | 3.87 | -0.10 | 0.00025 | -0.00066 | 0.00248 |
| 208 | C05 | Min | -0.05 | -3.87 | -0.15 | -0.00025 | -0.00095 | -0.00249 |
| 209 | C05 | Max | 0.05 | 4.06 | 0.00 | 0.00002 | -0.00075 | 0.00142 |
| 209 | C05 | Min | -0.05 | -4.05 | 0.00 | -0.00002 | -0.00111 | -0.00143 |
| 210 | C05 | Max | 0.04 | 4.06 | 0.00 | 0.00002 | -0.00075 | 0.00141 |
| 210 | C05 | Min | -0.06 | -4.05 | 0.00 | -0.00002 | -0.00111 | -0.00142 |
| 301 | C05 | Max | 11.93 | 3.57 | -0.18 | 0.00010 | -0.00053 | 0.00280 |
| 301 | C05 | Min | -12.01 | -3.57 | -0.27 | -0.00010 | -0.00076 | -0.00280 |
| 302 | C05 | Max | 12.05 | 3.57 | -0.18 | 0.00015 | -0.00053 | 0.00280 |
| 302 | C05 | Min | -12.13 | -3.57 | -0.26 | -0.00006 | -0.00076 | -0.00280 |
| 303 | C05 | Max | 11.93 | 3.88 | -0.11 | 0.00006 | -0.00055 | 0.00280 |
| 303 | C05 | Min | -12.01 | -3.88 | -0.15 | -0.00007 | -0.00079 | -0.00280 |
| 304 | C05 | Max | 12.05 | 3.88 | -0.10 | 0.00010 | -0.00055 | 0.00280 |
| 304 | C05 | Min | -12.13 | -3.88 | -0.15 | -0.00003 | -0.00079 | -0.00280 |
| 401 | C05 | Max | 11.95 | 3.57 | -0.18 | 0.00010 | -0.00053 | 0.00280 |
| 401 | C05 | Min | -12.00 | -3.57 | -0.27 | -0.00010 | -0.00076 | -0.00280 |
| 402 | C05 | Max | 12.06 | 3.57 | -0.18 | 0.00015 | -0.00053 | 0.00280 |
| 402 | C05 | Min | -12.11 | -3.57 | -0.26 | -0.00006 | -0.00076 | -0.00280 |
| 500 | C05 | Max | 13.14 | 6.26 | -0.15 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C05 | Min | -13.22 | -6.25 | -0.21 | 0.00000 | 0.00000 | 0.00000 |

| Case-05: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C05 | Max | 11.99 | 3.72 | -0.15 | 0.00009 | -0.00054 | 0.00280 |
| 501 | C05 | Min | -12.07 | -3.72 | -0.21 | -0.00006 | -0.00078 | -0.00280 |
| 600 | C05 | Max | 13.02 | 5.91 | -0.18 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C05 | Min | -13.10 | -5.91 | -0.25 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C05 | Max | 11.99 | 3.61 | -0.18 | 0.00012 | -0.00053 | 0.00280 |
| 601 | C05 | Min | -12.07 | -3.61 | -0.25 | -0.00007 | -0.00076 | -0.00280 |
| 701 | C05 | Max | 0.03 | 3.57 | -0.18 | 0.00037 | -0.00039 | 0.00303 |
| 701 | C05 | Min | -0.08 | -3.57 | -0.27 | -0.00037 | -0.00058 | -0.00303 |
| 702 | C05 | Max | 0.02 | 3.57 | -0.18 | 0.00042 | -0.00038 | 0.00303 |
| 702 | C05 | Min | -0.07 | -3.57 | -0.26 | -0.00042 | -0.00056 | -0.00304 |
| 703 | C05 | Max | 0.01 | 3.88 | -0.11 | 0.00025 | -0.00067 | 0.00249 |
| 703 | C05 | Min | -0.10 | -3.88 | -0.15 | -0.00025 | -0.00097 | -0.00249 |
| 704 | C05 | Max | 0.00 | 3.88 | -0.10 | 0.00025 | -0.00066 | 0.00248 |
| 704 | C05 | Min | -0.09 | -3.88 | -0.15 | -0.00025 | -0.00095 | -0.00249 |
| 801 | C05 | Max | 0.08 | 2.31 | 0.00 | 0.00001 | 0.00094 | 0.00053 |
| 801 | C05 | Min | -0.01 | -2.30 | 0.00 | -0.00001 | 0.00063 | -0.00052 |
| 802 | C05 | Max | 0.08 | 2.31 | 0.00 | 0.00000 | 0.00092 | 0.00019 |
| 802 | C05 | Min | -0.01 | -2.30 | -0.02 | 0.00000 | 0.00063 | -0.00018 |
| 803 | C05 | Max | 0.07 | 2.31 | 0.00 | 0.00002 | 0.00090 | 0.00054 |
| 803 | C05 | Min | 0.00 | -2.30 | 0.00 | -0.00001 | 0.00062 | -0.00054 |
| 804 | C05 | Max | 0.01 | 4.05 | 0.00 | 0.00001 | -0.00078 | 0.00140 |
| 804 | C05 | Min | -0.10 | -4.05 | 0.00 | -0.00002 | -0.00113 | -0.00140 |
| 805 | C05 | Max | 0.01 | 4.06 | 0.00 | 0.00001 | -0.00078 | 0.00044 |
| 805 | C05 | Min | -0.10 | -4.05 | -0.02 | -0.00001 | -0.00110 | -0.00045 |
| 806 | C05 | Max | 0.01 | 4.06 | 0.00 | 0.00002 | -0.00075 | 0.00139 |
| 806 | C05 | Min | -0.09 | -4.05 | 0.00 | -0.00002 | -0.00111 | -0.00140 |
| | **C05** | **MAX:** | **13.22** | **6.26** | **0.32** | **0.00042** | **0.00256** | **0.00339** |

## Case-06

| Case-06: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C06 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C06 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C06 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C06 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C06 | Max | 0.00 | 2.46 | 0.00 | -0.00001 | 0.00227 | 0.00073 |
| 10 | C06 | Min | 0.00 | -2.45 | 0.00 | -0.00010 | -0.00118 | -0.00073 |
| 11 | C06 | Max | 0.00 | 2.46 | 0.00 | 0.00009 | 0.00204 | 0.00079 |
| 11 | C06 | Min | 0.00 | -2.45 | 0.00 | 0.00002 | -0.00096 | -0.00079 |
| 12 | C06 | Max | 0.00 | 2.46 | 0.00 | -0.00004 | 0.00184 | 0.00068 |
| 12 | C06 | Min | 0.00 | -2.45 | 0.00 | -0.00007 | -0.00080 | -0.00068 |
| 13 | C06 | Max | 0.00 | 2.46 | 0.00 | 0.00006 | 0.00200 | 0.00063 |
| 13 | C06 | Min | 0.00 | -2.45 | 0.00 | 0.00004 | -0.00097 | -0.00063 |
| 14 | C06 | Max | 0.09 | 3.72 | 0.00 | -0.00010 | -0.00050 | 0.00135 |
| 14 | C06 | Min | -0.09 | -3.72 | 0.00 | -0.00018 | -0.00076 | -0.00135 |
| 15 | C06 | Max | 0.06 | 3.73 | 0.00 | 0.00018 | -0.00050 | 0.00136 |
| 15 | C06 | Min | -0.06 | -3.72 | 0.00 | 0.00010 | -0.00076 | -0.00136 |
| 16 | C06 | Max | 0.07 | 3.72 | 0.00 | -0.00011 | -0.00049 | 0.00134 |
| 16 | C06 | Min | -0.06 | -3.72 | 0.00 | -0.00016 | -0.00074 | -0.00135 |
| 17 | C06 | Max | 0.08 | 3.73 | 0.00 | 0.00016 | -0.00049 | 0.00134 |
| 17 | C06 | Min | -0.08 | -3.72 | 0.00 | 0.00011 | -0.00074 | -0.00135 |
| 21 | C06 | Max | 0.04 | 2.46 | 0.00 | -0.00001 | 0.00227 | 0.00073 |
| 21 | C06 | Min | -0.02 | -2.45 | 0.00 | -0.00010 | -0.00118 | -0.00073 |
| 22 | C06 | Max | 0.03 | 2.46 | 0.00 | 0.00009 | 0.00204 | 0.00079 |
| 22 | C06 | Min | -0.02 | -2.45 | 0.00 | 0.00002 | -0.00096 | -0.00079 |
| 23 | C06 | Max | 0.03 | 2.46 | 0.00 | -0.00004 | 0.00184 | 0.00068 |
| 23 | C06 | Min | -0.01 | -2.45 | 0.00 | -0.00007 | -0.00080 | -0.00068 |
| 24 | C06 | Max | 0.03 | 2.46 | 0.00 | 0.00006 | 0.00200 | 0.00063 |
| 24 | C06 | Min | -0.02 | -2.45 | 0.00 | 0.00004 | -0.00096 | -0.00063 |
| 25 | C06 | Max | 0.08 | 3.72 | 0.00 | -0.00010 | -0.00050 | 0.00135 |
| 25 | C06 | Min | -0.10 | -3.72 | 0.00 | -0.00018 | -0.00076 | -0.00135 |
| 26 | C06 | Max | 0.05 | 3.72 | 0.00 | 0.00018 | -0.00050 | 0.00136 |
| 26 | C06 | Min | -0.07 | -3.72 | 0.00 | 0.00010 | -0.00076 | -0.00136 |
| 27 | C06 | Max | 0.05 | 3.72 | 0.00 | -0.00011 | -0.00049 | 0.00134 |
| 27 | C06 | Min | -0.07 | -3.72 | 0.00 | -0.00016 | -0.00074 | -0.00135 |
| 28 | C06 | Max | 0.07 | 3.72 | 0.00 | 0.00016 | -0.00049 | 0.00134 |
| 28 | C06 | Min | -0.09 | -3.72 | 0.00 | 0.00011 | -0.00074 | -0.00135 |
| 100 | C06 | Max | 0.05 | 2.46 | 0.00 | 0.00000 | 0.00066 | 0.00048 |
| 100 | C06 | Min | -0.03 | -2.45 | 0.00 | -0.00001 | 0.00043 | -0.00047 |
| 101 | C06 | Max | 0.04 | 2.46 | 0.00 | 0.00000 | 0.00066 | 0.00048 |
| 101 | C06 | Min | -0.04 | -2.45 | 0.00 | -0.00001 | 0.00043 | -0.00048 |
| 102 | C06 | Max | 0.05 | 2.53 | -0.06 | 0.00004 | 0.00059 | 0.00155 |
| 102 | C06 | Min | -0.04 | -2.52 | -0.09 | -0.00004 | 0.00038 | -0.00155 |
| 103 | C06 | Max | 0.05 | 2.64 | -0.11 | 0.00008 | 0.00042 | 0.00231 |
| 103 | C06 | Min | -0.05 | -2.64 | -0.17 | -0.00008 | 0.00028 | -0.00231 |
| 104 | C06 | Max | 0.05 | 2.87 | -0.14 | 0.00012 | 0.00012 | 0.00305 |
| 104 | C06 | Min | -0.05 | -2.87 | -0.21 | -0.00013 | 0.00007 | -0.00305 |
| 105 | C06 | Max | 0.05 | 2.93 | -0.14 | 0.00013 | 0.00006 | 0.00314 |

| Case-06: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C06 | Min | -0.05 | -2.93 | -0.22 | -0.00013 | 0.00002 | -0.00315 |
| 106 | C06 | Max | 0.06 | 3.15 | -0.13 | 0.00017 | -0.00014 | 0.00324 |
| 106 | C06 | Min | -0.05 | -3.15 | -0.20 | -0.00017 | -0.00022 | -0.00324 |
| 107 | C06 | Max | 0.06 | 3.29 | -0.12 | 0.00019 | -0.00025 | 0.00310 |
| 107 | C06 | Min | -0.05 | -3.29 | -0.18 | -0.00019 | -0.00038 | -0.00311 |
| 108 | C06 | Max | 0.06 | 3.52 | -0.07 | 0.00023 | -0.00042 | 0.00251 |
| 108 | C06 | Min | -0.06 | -3.52 | -0.11 | -0.00023 | -0.00064 | -0.00251 |
| 109 | C06 | Max | 0.06 | 3.72 | 0.00 | 0.00002 | -0.00050 | 0.00136 |
| 109 | C06 | Min | -0.06 | -3.72 | 0.00 | -0.00002 | -0.00076 | -0.00137 |
| 110 | C06 | Max | 0.05 | 3.72 | 0.00 | 0.00002 | -0.00050 | 0.00135 |
| 110 | C06 | Min | -0.07 | -3.72 | 0.00 | -0.00002 | -0.00076 | -0.00136 |
| 200 | C06 | Max | 0.05 | 2.46 | 0.00 | 0.00002 | 0.00062 | 0.00045 |
| 200 | C06 | Min | -0.03 | -2.45 | 0.00 | -0.00001 | 0.00041 | -0.00045 |
| 201 | C06 | Max | 0.04 | 2.46 | 0.00 | 0.00002 | 0.00062 | 0.00046 |
| 201 | C06 | Min | -0.04 | -2.45 | 0.00 | -0.00001 | 0.00041 | -0.00046 |
| 202 | C06 | Max | 0.04 | 2.51 | -0.06 | 0.00005 | 0.00056 | 0.00150 |
| 202 | C06 | Min | -0.04 | -2.50 | -0.09 | -0.00005 | 0.00037 | -0.00150 |
| 203 | C06 | Max | 0.04 | 2.61 | -0.10 | 0.00009 | 0.00040 | 0.00230 |
| 203 | C06 | Min | -0.04 | -2.60 | -0.16 | -0.00009 | 0.00027 | -0.00229 |
| 204 | C06 | Max | 0.05 | 2.85 | -0.14 | 0.00014 | 0.00012 | 0.00305 |
| 204 | C06 | Min | -0.04 | -2.84 | -0.20 | -0.00014 | 0.00007 | -0.00304 |
| 205 | C06 | Max | 0.05 | 2.91 | -0.14 | 0.00015 | 0.00006 | 0.00315 |
| 205 | C06 | Min | -0.04 | -2.91 | -0.21 | -0.00015 | 0.00003 | -0.00314 |
| 206 | C06 | Max | 0.05 | 3.14 | -0.13 | 0.00019 | -0.00013 | 0.00323 |
| 206 | C06 | Min | -0.05 | -3.14 | -0.20 | -0.00019 | -0.00020 | -0.00323 |
| 207 | C06 | Max | 0.05 | 3.29 | -0.12 | 0.00021 | -0.00024 | 0.00305 |
| 207 | C06 | Min | -0.05 | -3.28 | -0.17 | -0.00021 | -0.00036 | -0.00305 |
| 208 | C06 | Max | 0.05 | 3.52 | -0.07 | 0.00025 | -0.00041 | 0.00244 |
| 208 | C06 | Min | -0.05 | -3.52 | -0.11 | -0.00025 | -0.00062 | -0.00245 |
| 209 | C06 | Max | 0.05 | 3.72 | 0.00 | 0.00001 | -0.00049 | 0.00135 |
| 209 | C06 | Min | -0.05 | -3.72 | 0.00 | -0.00001 | -0.00074 | -0.00136 |
| 210 | C06 | Max | 0.04 | 3.72 | 0.00 | 0.00001 | -0.00049 | 0.00134 |
| 210 | C06 | Min | -0.06 | -3.72 | 0.00 | -0.00001 | -0.00074 | -0.00135 |
| 301 | C06 | Max | 12.38 | 3.53 | -0.07 | 0.00001 | -0.00046 | 0.00198 |
| 301 | C06 | Min | -12.47 | -3.52 | -0.11 | -0.00004 | -0.00070 | -0.00198 |
| 302 | C06 | Max | 12.46 | 3.53 | -0.07 | 0.00006 | -0.00046 | 0.00198 |
| 302 | C06 | Min | -12.54 | -3.52 | -0.11 | 0.00001 | -0.00070 | -0.00198 |
| 303 | C06 | Max | 12.38 | 3.72 | 0.00 | -0.00001 | -0.00049 | 0.00198 |
| 303 | C06 | Min | -12.47 | -3.72 | 0.00 | -0.00002 | -0.00073 | -0.00198 |
| 304 | C06 | Max | 12.46 | 3.72 | 0.00 | 0.00003 | -0.00048 | 0.00198 |
| 304 | C06 | Min | -12.54 | -3.72 | 0.00 | 0.00001 | -0.00073 | -0.00198 |
| 401 | C06 | Max | 12.40 | 3.53 | -0.07 | 0.00001 | -0.00046 | 0.00198 |
| 401 | C06 | Min | -12.45 | -3.52 | -0.11 | -0.00004 | -0.00070 | -0.00198 |
| 402 | C06 | Max | 12.47 | 3.53 | -0.07 | 0.00006 | -0.00046 | 0.00198 |
| 402 | C06 | Min | -12.53 | -3.52 | -0.11 | 0.00001 | -0.00070 | -0.00198 |
| 500 | C06 | Max | 13.68 | 6.18 | -0.04 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C06 | Min | -13.77 | -6.18 | -0.06 | 0.00000 | 0.00000 | 0.00000 |
| 501 | C06 | Max | 12.42 | 3.62 | -0.04 | 0.00001 | -0.00047 | 0.00198 |

| Case-06: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C06 | Min | -12.50 | -3.62 | -0.06 | 0.00000 | -0.00071 | -0.00198 |
| 600 | C06 | Max | 13.88 | 5.86 | -0.07 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C06 | Min | -13.96 | -5.86 | -0.10 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C06 | Max | 12.42 | 3.55 | -0.06 | 0.00003 | -0.00046 | 0.00198 |
| 601 | C06 | Min | -12.50 | -3.54 | -0.10 | -0.00001 | -0.00070 | -0.00198 |
| 701 | C06 | Max | 0.03 | 3.53 | -0.07 | 0.00023 | -0.00042 | 0.00251 |
| 701 | C06 | Min | -0.09 | -3.52 | -0.11 | -0.00023 | -0.00064 | -0.00251 |
| 702 | C06 | Max | 0.02 | 3.53 | -0.07 | 0.00025 | -0.00041 | 0.00244 |
| 702 | C06 | Min | -0.08 | -3.52 | -0.11 | -0.00025 | -0.00062 | -0.00245 |
| 703 | C06 | Max | 0.02 | 3.72 | 0.00 | 0.00002 | -0.00050 | 0.00136 |
| 703 | C06 | Min | -0.09 | -3.72 | 0.00 | -0.00002 | -0.00076 | -0.00137 |
| 704 | C06 | Max | 0.02 | 3.73 | 0.00 | 0.00001 | -0.00049 | 0.00135 |
| 704 | C06 | Min | -0.08 | -3.72 | 0.00 | -0.00001 | -0.00074 | -0.00136 |
| 801 | C06 | Max | 0.07 | 2.46 | 0.00 | 0.00000 | 0.00066 | 0.00047 |
| 801 | C06 | Min | -0.02 | -2.45 | 0.00 | -0.00001 | 0.00043 | -0.00047 |
| 802 | C06 | Max | 0.07 | 2.46 | -0.01 | 0.00000 | 0.00064 | 0.00015 |
| 802 | C06 | Min | -0.02 | -2.45 | -0.01 | 0.00000 | 0.00042 | -0.00014 |
| 803 | C06 | Max | 0.06 | 2.46 | 0.00 | 0.00002 | 0.00062 | 0.00045 |
| 803 | C06 | Min | -0.01 | -2.45 | 0.00 | -0.00001 | 0.00041 | -0.00044 |
| 804 | C06 | Max | 0.03 | 3.72 | 0.00 | 0.00002 | -0.00050 | 0.00133 |
| 804 | C06 | Min | -0.09 | -3.72 | 0.00 | -0.00002 | -0.00076 | -0.00134 |
| 805 | C06 | Max | 0.02 | 3.72 | -0.01 | 0.00001 | -0.00050 | 0.00045 |
| 805 | C06 | Min | -0.08 | -3.72 | -0.02 | -0.00001 | -0.00075 | -0.00045 |
| 806 | C06 | Max | 0.02 | 3.73 | 0.00 | 0.00001 | -0.00049 | 0.00132 |
| 806 | C06 | Min | -0.08 | -3.72 | 0.00 | -0.00001 | -0.00074 | -0.00133 |
| | **C06** | **MAX:** | **13.96** | **6.18** | **0.22** | **0.00025** | **0.00227** | **0.00324** |

**Case-07**

| Case-07: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C07 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C07 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C07 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C07 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C07 | Max | 0.00 | 5.33 | 0.00 | -0.00007 | 0.00498 | 0.00074 |
| 10 | C07 | Min | 0.00 | -5.32 | 0.00 | -0.00033 | 0.00027 | -0.00074 |
| 11 | C07 | Max | 0.00 | 5.33 | 0.00 | 0.00033 | 0.00512 | 0.00069 |
| 11 | C07 | Min | 0.00 | -5.32 | 0.00 | 0.00008 | 0.00013 | -0.00069 |
| 12 | C07 | Max | 0.00 | 5.33 | 0.00 | -0.00008 | 0.00500 | 0.00066 |
| 12 | C07 | Min | 0.00 | -5.33 | 0.00 | -0.00031 | 0.00019 | -0.00066 |
| 13 | C07 | Max | 0.00 | 5.34 | 0.00 | 0.00031 | 0.00490 | 0.00067 |
| 13 | C07 | Min | 0.00 | -5.32 | 0.00 | 0.00008 | 0.00026 | -0.00067 |
| 14 | C07 | Max | 0.08 | 5.28 | 0.00 | -0.00007 | -0.00099 | 0.00098 |
| 14 | C07 | Min | -0.07 | -5.29 | 0.00 | -0.00037 | -0.00446 | -0.00099 |
| 15 | C07 | Max | 0.07 | 5.29 | 0.00 | 0.00036 | -0.00099 | 0.00098 |
| 15 | C07 | Min | -0.05 | -5.28 | 0.00 | 0.00008 | -0.00446 | -0.00099 |
| 16 | C07 | Max | 0.07 | 5.29 | 0.00 | -0.00009 | -0.00097 | 0.00097 |
| 16 | C07 | Min | -0.05 | -5.29 | 0.00 | -0.00035 | -0.00439 | -0.00099 |
| 17 | C07 | Max | 0.07 | 5.30 | 0.00 | 0.00035 | -0.00097 | 0.00097 |
| 17 | C07 | Min | -0.06 | -5.28 | 0.00 | 0.00008 | -0.00439 | -0.00099 |
| 21 | C07 | Max | 0.08 | 5.33 | 0.00 | -0.00007 | 0.00498 | 0.00074 |
| 21 | C07 | Min | 0.00 | -5.32 | 0.00 | -0.00033 | 0.00027 | -0.00074 |
| 22 | C07 | Max | 0.08 | 5.33 | 0.00 | 0.00033 | 0.00512 | 0.00069 |
| 22 | C07 | Min | 0.00 | -5.32 | 0.00 | 0.00008 | 0.00013 | -0.00069 |
| 23 | C07 | Max | 0.08 | 5.33 | 0.00 | -0.00008 | 0.00499 | 0.00066 |
| 23 | C07 | Min | 0.00 | -5.32 | 0.00 | -0.00031 | 0.00019 | -0.00066 |
| 24 | C07 | Max | 0.08 | 5.33 | 0.00 | 0.00031 | 0.00490 | 0.00067 |
| 24 | C07 | Min | 0.00 | -5.32 | 0.00 | 0.00008 | 0.00026 | -0.00067 |
| 25 | C07 | Max | 0.04 | 5.29 | 0.00 | -0.00007 | -0.00099 | 0.00098 |
| 25 | C07 | Min | -0.12 | -5.28 | 0.00 | -0.00037 | -0.00446 | -0.00099 |
| 26 | C07 | Max | 0.03 | 5.29 | 0.00 | 0.00036 | -0.00099 | 0.00098 |
| 26 | C07 | Min | -0.10 | -5.28 | 0.00 | 0.00008 | -0.00446 | -0.00099 |
| 27 | C07 | Max | 0.03 | 5.29 | 0.00 | -0.00009 | -0.00097 | 0.00097 |
| 27 | C07 | Min | -0.10 | -5.29 | 0.00 | -0.00035 | -0.00439 | -0.00099 |
| 28 | C07 | Max | 0.04 | 5.29 | 0.00 | 0.00035 | -0.00097 | 0.00097 |
| 28 | C07 | Min | -0.11 | -5.29 | 0.00 | 0.00008 | -0.00439 | -0.00099 |
| 100 | C07 | Max | 0.10 | 5.33 | 0.00 | 0.00002 | 0.00429 | 0.00051 |
| 100 | C07 | Min | -0.01 | -5.32 | -0.01 | -0.00002 | 0.00097 | -0.00051 |
| 101 | C07 | Max | 0.04 | 5.33 | 0.00 | 0.00002 | 0.00429 | 0.00052 |
| 101 | C07 | Min | -0.04 | -5.32 | -0.01 | -0.00002 | 0.00097 | -0.00052 |
| 102 | C07 | Max | 0.05 | 5.36 | -0.14 | 0.00030 | 0.00391 | 0.00158 |
| 102 | C07 | Min | -0.04 | -5.35 | -0.62 | -0.00030 | 0.00087 | -0.00159 |
| 103 | C07 | Max | 0.05 | 5.40 | -0.24 | 0.00056 | 0.00287 | 0.00173 |
| 103 | C07 | Min | -0.04 | -5.39 | -1.09 | -0.00056 | 0.00063 | -0.00174 |
| 104 | C07 | Max | 0.05 | 5.43 | -0.31 | 0.00090 | 0.00067 | 0.00069 |
| 104 | C07 | Min | -0.05 | -5.43 | -1.41 | -0.00090 | 0.00014 | -0.00070 |

| Case-07: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C07 | Max | 0.05 | 5.43 | -0.32 | 0.00089 | 0.00011 | 0.00035 |
| 105 | C07 | Min | -0.05 | -5.43 | -1.43 | -0.00088 | 0.00001 | -0.00036 |
| 106 | C07 | Max | 0.06 | 5.42 | -0.30 | 0.00085 | -0.00034 | 0.00086 |
| 106 | C07 | Min | -0.05 | -5.41 | -1.35 | -0.00085 | -0.00154 | -0.00087 |
| 107 | C07 | Max | 0.06 | 5.38 | -0.25 | 0.00063 | -0.00063 | 0.00150 |
| 107 | C07 | Min | -0.05 | -5.38 | -1.12 | -0.00063 | -0.00286 | -0.00150 |
| 108 | C07 | Max | 0.06 | 5.33 | -0.14 | 0.00033 | -0.00089 | 0.00166 |
| 108 | C07 | Min | -0.05 | -5.32 | -0.64 | -0.00033 | -0.00403 | -0.00166 |
| 109 | C07 | Max | 0.06 | 5.29 | 0.00 | 0.00002 | -0.00099 | 0.00099 |
| 109 | C07 | Min | -0.05 | -5.28 | -0.01 | -0.00002 | -0.00446 | -0.00099 |
| 110 | C07 | Max | 0.02 | 5.29 | 0.00 | 0.00002 | -0.00099 | 0.00098 |
| 110 | C07 | Min | -0.10 | -5.28 | -0.01 | -0.00002 | -0.00446 | -0.00099 |
| 200 | C07 | Max | 0.09 | 5.33 | 0.00 | 0.00002 | 0.00423 | 0.00051 |
| 200 | C07 | Min | -0.01 | -5.32 | -0.01 | -0.00001 | 0.00095 | -0.00050 |
| 201 | C07 | Max | 0.04 | 5.33 | 0.00 | 0.00002 | 0.00423 | 0.00052 |
| 201 | C07 | Min | -0.03 | -5.32 | -0.01 | -0.00001 | 0.00095 | -0.00051 |
| 202 | C07 | Max | 0.04 | 5.36 | -0.14 | 0.00029 | 0.00385 | 0.00159 |
| 202 | C07 | Min | -0.04 | -5.35 | -0.61 | -0.00029 | 0.00086 | -0.00157 |
| 203 | C07 | Max | 0.05 | 5.40 | -0.24 | 0.00055 | 0.00283 | 0.00173 |
| 203 | C07 | Min | -0.04 | -5.39 | -1.08 | -0.00055 | 0.00062 | -0.00172 |
| 204 | C07 | Max | 0.05 | 5.44 | -0.31 | 0.00089 | 0.00066 | 0.00069 |
| 204 | C07 | Min | -0.04 | -5.42 | -1.39 | -0.00089 | 0.00014 | -0.00069 |
| 205 | C07 | Max | 0.05 | 5.44 | -0.31 | 0.00087 | 0.00011 | 0.00035 |
| 205 | C07 | Min | -0.04 | -5.43 | -1.41 | -0.00087 | 0.00001 | -0.00035 |
| 206 | C07 | Max | 0.05 | 5.42 | -0.29 | 0.00083 | -0.00034 | 0.00085 |
| 206 | C07 | Min | -0.04 | -5.41 | -1.33 | -0.00083 | -0.00152 | -0.00086 |
| 207 | C07 | Max | 0.05 | 5.39 | -0.24 | 0.00061 | -0.00062 | 0.00148 |
| 207 | C07 | Min | -0.04 | -5.37 | -1.11 | -0.00061 | -0.00282 | -0.00149 |
| 208 | C07 | Max | 0.05 | 5.33 | -0.14 | 0.00032 | -0.00087 | 0.00165 |
| 208 | C07 | Min | -0.04 | -5.32 | -0.63 | -0.00032 | -0.00397 | -0.00167 |
| 209 | C07 | Max | 0.05 | 5.29 | 0.00 | 0.00002 | -0.00097 | 0.00098 |
| 209 | C07 | Min | -0.05 | -5.29 | -0.01 | -0.00002 | -0.00439 | -0.00100 |
| 210 | C07 | Max | 0.02 | 5.29 | 0.00 | 0.00002 | -0.00097 | 0.00097 |
| 210 | C07 | Min | -0.09 | -5.29 | -0.01 | -0.00002 | -0.00439 | -0.00099 |
| 301 | C07 | Max | 10.34 | 5.45 | -0.31 | 0.00005 | -0.00008 | 0.00033 |
| 301 | C07 | Min | -10.30 | -5.44 | -1.41 | -0.00008 | -0.00035 | -0.00033 |
| 302 | C07 | Max | 10.32 | 5.45 | -0.31 | 0.00021 | -0.00008 | 0.00033 |
| 302 | C07 | Min | -10.28 | -5.44 | -1.39 | 0.00004 | -0.00035 | -0.00033 |
| 303 | C07 | Max | 10.34 | 5.43 | -0.30 | 0.00004 | -0.00012 | 0.00034 |
| 303 | C07 | Min | -10.30 | -5.43 | -1.35 | -0.00009 | -0.00052 | -0.00034 |
| 304 | C07 | Max | 10.32 | 5.43 | -0.29 | 0.00022 | -0.00012 | 0.00034 |
| 304 | C07 | Min | -10.28 | -5.43 | -1.33 | 0.00003 | -0.00052 | -0.00034 |
| 401 | C07 | Max | 10.35 | 5.45 | -0.31 | 0.00005 | -0.00008 | 0.00033 |
| 401 | C07 | Min | -10.29 | -5.44 | -1.41 | -0.00008 | -0.00035 | -0.00033 |
| 402 | C07 | Max | 10.33 | 5.45 | -0.31 | 0.00021 | -0.00008 | 0.00033 |
| 402 | C07 | Min | -10.28 | -5.44 | -1.39 | 0.00004 | -0.00035 | -0.00033 |
| 500 | C07 | Max | 12.36 | 7.12 | -0.48 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C07 | Min | -12.31 | -7.11 | -3.39 | 0.00000 | 0.00000 | 0.00000 |

| Case-07: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C07 | Max | 10.33 | 5.44 | -0.31 | 0.00010 | -0.00010 | 0.00033 |
| 501 | C07 | Min | -10.29 | -5.43 | -1.38 | 0.00001 | -0.00044 | -0.00034 |
| 600 | C07 | Max | 13.96 | 8.39 | -0.31 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C07 | Min | -13.91 | -8.39 | -1.41 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C07 | Max | 10.33 | 5.45 | -0.31 | 0.00010 | -0.00009 | 0.00033 |
| 601 | C07 | Min | -10.29 | -5.44 | -1.41 | 0.00001 | -0.00037 | -0.00033 |
| 701 | C07 | Max | 0.08 | 5.45 | -0.31 | 0.00090 | 0.00067 | 0.00069 |
| 701 | C07 | Min | -0.03 | -5.44 | -1.41 | -0.00090 | 0.00014 | -0.00070 |
| 702 | C07 | Max | 0.08 | 5.45 | -0.31 | 0.00089 | 0.00066 | 0.00069 |
| 702 | C07 | Min | -0.02 | -5.44 | -1.39 | -0.00089 | 0.00014 | -0.00069 |
| 703 | C07 | Max | 0.01 | 5.43 | -0.30 | 0.00085 | -0.00034 | 0.00086 |
| 703 | C07 | Min | -0.11 | -5.42 | -1.35 | -0.00085 | -0.00154 | -0.00087 |
| 704 | C07 | Max | 0.01 | 5.44 | -0.29 | 0.00083 | -0.00034 | 0.00085 |
| 704 | C07 | Min | -0.10 | -5.42 | -1.33 | -0.00083 | -0.00152 | -0.00086 |
| 801 | C07 | Max | 0.22 | 5.33 | 0.00 | 0.00002 | 0.00429 | 0.00050 |
| 801 | C07 | Min | 0.03 | -5.32 | -0.01 | -0.00002 | 0.00097 | -0.00050 |
| 802 | C07 | Max | 0.22 | 5.33 | -0.01 | 0.00001 | 0.00426 | 0.00030 |
| 802 | C07 | Min | 0.03 | -5.32 | -0.02 | -0.00001 | 0.00096 | -0.00028 |
| 803 | C07 | Max | 0.22 | 5.33 | 0.00 | 0.00002 | 0.00423 | 0.00050 |
| 803 | C07 | Min | 0.03 | -5.32 | -0.01 | -0.00001 | 0.00095 | -0.00050 |
| 804 | C07 | Max | -0.02 | 5.29 | 0.00 | 0.00002 | -0.00099 | 0.00097 |
| 804 | C07 | Min | -0.23 | -5.28 | -0.01 | -0.00002 | -0.00446 | -0.00097 |
| 805 | C07 | Max | -0.02 | 5.29 | -0.01 | 0.00001 | -0.00098 | 0.00037 |
| 805 | C07 | Min | -0.23 | -5.28 | -0.02 | -0.00001 | -0.00442 | -0.00039 |
| 806 | C07 | Max | -0.02 | 5.29 | 0.00 | 0.00002 | -0.00097 | 0.00095 |
| 806 | C07 | Min | -0.22 | -5.29 | -0.01 | -0.00002 | -0.00439 | -0.00098 |
| | **C07** | **MAX:** | **13.96** | **8.39** | **3.39** | **0.00090** | **0.00512** | **0.00174** |

**Case-08**

| Case-08: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C08 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C08 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C08 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C08 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C08 | Max | 0.00 | 2.59 | 0.00 | -0.00004 | 0.00380 | 0.00073 |
| 10 | C08 | Min | 0.00 | -2.58 | 0.00 | -0.00019 | -0.00049 | -0.00073 |
| 11 | C08 | Max | 0.00 | 2.59 | 0.00 | 0.00019 | 0.00340 | 0.00079 |
| 11 | C08 | Min | 0.00 | -2.58 | 0.00 | 0.00005 | -0.00009 | -0.00079 |
| 12 | C08 | Max | 0.00 | 2.59 | 0.00 | -0.00006 | 0.00333 | 0.00069 |
| 12 | C08 | Min | 0.00 | -2.58 | 0.00 | -0.00017 | -0.00006 | -0.00069 |
| 13 | C08 | Max | 0.00 | 2.59 | 0.00 | 0.00016 | 0.00346 | 0.00064 |
| 13 | C08 | Min | 0.00 | -2.58 | 0.00 | 0.00006 | -0.00021 | -0.00063 |
| 14 | C08 | Max | 0.10 | 4.26 | 0.00 | -0.00013 | -0.00114 | 0.00144 |
| 14 | C08 | Min | -0.09 | -4.26 | 0.00 | -0.00047 | -0.00324 | -0.00143 |
| 15 | C08 | Max | 0.06 | 4.27 | 0.00 | 0.00047 | -0.00114 | 0.00144 |
| 15 | C08 | Min | -0.05 | -4.25 | 0.00 | 0.00014 | -0.00324 | -0.00143 |
| 16 | C08 | Max | 0.07 | 4.26 | 0.00 | -0.00015 | -0.00112 | 0.00141 |
| 16 | C08 | Min | -0.06 | -4.26 | 0.00 | -0.00045 | -0.00321 | -0.00144 |
| 17 | C08 | Max | 0.09 | 4.27 | 0.00 | 0.00044 | -0.00112 | 0.00141 |
| 17 | C08 | Min | -0.07 | -4.25 | 0.00 | 0.00015 | -0.00321 | -0.00144 |
| 21 | C08 | Max | 0.06 | 2.59 | 0.00 | -0.00004 | 0.00380 | 0.00073 |
| 21 | C08 | Min | -0.01 | -2.58 | 0.00 | -0.00019 | -0.00049 | -0.00073 |
| 22 | C08 | Max | 0.06 | 2.59 | 0.00 | 0.00019 | 0.00340 | 0.00079 |
| 22 | C08 | Min | 0.00 | -2.58 | 0.00 | 0.00005 | -0.00009 | -0.00079 |
| 23 | C08 | Max | 0.05 | 2.59 | 0.00 | -0.00006 | 0.00333 | 0.00069 |
| 23 | C08 | Min | 0.00 | -2.58 | 0.00 | -0.00017 | -0.00006 | -0.00069 |
| 24 | C08 | Max | 0.06 | 2.59 | 0.00 | 0.00016 | 0.00346 | 0.00064 |
| 24 | C08 | Min | 0.00 | -2.58 | 0.00 | 0.00006 | -0.00021 | -0.00063 |
| 25 | C08 | Max | 0.06 | 4.26 | 0.00 | -0.00013 | -0.00114 | 0.00144 |
| 25 | C08 | Min | -0.12 | -4.26 | 0.00 | -0.00047 | -0.00324 | -0.00143 |
| 26 | C08 | Max | 0.03 | 4.26 | 0.00 | 0.00047 | -0.00114 | 0.00144 |
| 26 | C08 | Min | -0.09 | -4.26 | 0.00 | 0.00014 | -0.00324 | -0.00143 |
| 27 | C08 | Max | 0.03 | 4.27 | 0.00 | -0.00015 | -0.00112 | 0.00141 |
| 27 | C08 | Min | -0.09 | -4.26 | 0.00 | -0.00045 | -0.00321 | -0.00144 |
| 28 | C08 | Max | 0.05 | 4.27 | 0.00 | 0.00044 | -0.00112 | 0.00141 |
| 28 | C08 | Min | -0.11 | -4.26 | 0.00 | 0.00015 | -0.00321 | -0.00144 |
| 100 | C08 | Max | 0.07 | 2.59 | 0.00 | 0.00001 | 0.00242 | 0.00053 |
| 100 | C08 | Min | -0.02 | -2.58 | 0.00 | -0.00001 | 0.00089 | -0.00052 |
| 101 | C08 | Max | 0.04 | 2.59 | 0.00 | 0.00001 | 0.00242 | 0.00054 |
| 101 | C08 | Min | -0.04 | -2.58 | 0.00 | -0.00001 | 0.00089 | -0.00053 |
| 102 | C08 | Max | 0.05 | 2.68 | -0.13 | 0.00008 | 0.00223 | 0.00177 |
| 102 | C08 | Min | -0.04 | -2.68 | -0.35 | -0.00008 | 0.00082 | -0.00177 |
| 103 | C08 | Max | 0.05 | 2.87 | -0.23 | 0.00015 | 0.00172 | 0.00264 |
| 103 | C08 | Min | -0.04 | -2.87 | -0.62 | -0.00015 | 0.00062 | -0.00264 |
| 104 | C08 | Max | 0.05 | 3.22 | -0.30 | 0.00024 | 0.00067 | 0.00334 |
| 104 | C08 | Min | -0.05 | -3.21 | -0.84 | -0.00024 | 0.00021 | -0.00335 |

| Case-08: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C08 | Max | 0.05 | 3.30 | -0.31 | 0.00026 | 0.00041 | 0.00342 |
| 105 | C08 | Min | -0.05 | -3.29 | -0.86 | -0.00026 | 0.00011 | -0.00343 |
| 106 | C08 | Max | 0.06 | 3.61 | -0.30 | 0.00033 | -0.00030 | 0.00332 |
| 106 | C08 | Min | -0.05 | -3.60 | -0.83 | -0.00033 | -0.00079 | -0.00333 |
| 107 | C08 | Max | 0.06 | 3.78 | -0.27 | 0.00037 | -0.00055 | 0.00305 |
| 107 | C08 | Min | -0.05 | -3.77 | -0.75 | -0.00037 | -0.00149 | -0.00306 |
| 108 | C08 | Max | 0.06 | 4.08 | -0.15 | 0.00025 | -0.00098 | 0.00252 |
| 108 | C08 | Min | -0.05 | -4.08 | -0.44 | -0.00024 | -0.00275 | -0.00252 |
| 109 | C08 | Max | 0.06 | 4.26 | 0.00 | 0.00001 | -0.00114 | 0.00145 |
| 109 | C08 | Min | -0.05 | -4.26 | -0.01 | -0.00002 | -0.00324 | -0.00143 |
| 110 | C08 | Max | 0.03 | 4.26 | 0.00 | 0.00001 | -0.00114 | 0.00144 |
| 110 | C08 | Min | -0.09 | -4.26 | -0.01 | -0.00002 | -0.00324 | -0.00142 |
| 200 | C08 | Max | 0.07 | 2.59 | 0.00 | 0.00002 | 0.00238 | 0.00056 |
| 200 | C08 | Min | -0.01 | -2.58 | 0.00 | -0.00002 | 0.00088 | -0.00056 |
| 201 | C08 | Max | 0.04 | 2.59 | 0.00 | 0.00002 | 0.00238 | 0.00057 |
| 201 | C08 | Min | -0.03 | -2.58 | 0.00 | -0.00002 | 0.00088 | -0.00057 |
| 202 | C08 | Max | 0.04 | 2.68 | -0.13 | 0.00010 | 0.00220 | 0.00182 |
| 202 | C08 | Min | -0.04 | -2.67 | -0.34 | -0.00009 | 0.00080 | -0.00181 |
| 203 | C08 | Max | 0.04 | 2.87 | -0.23 | 0.00017 | 0.00170 | 0.00263 |
| 203 | C08 | Min | -0.04 | -2.86 | -0.61 | -0.00017 | 0.00061 | -0.00262 |
| 204 | C08 | Max | 0.05 | 3.22 | -0.30 | 0.00027 | 0.00068 | 0.00336 |
| 204 | C08 | Min | -0.04 | -3.21 | -0.83 | -0.00027 | 0.00021 | -0.00336 |
| 205 | C08 | Max | 0.05 | 3.30 | -0.30 | 0.00029 | 0.00041 | 0.00345 |
| 205 | C08 | Min | -0.04 | -3.29 | -0.85 | -0.00029 | 0.00011 | -0.00344 |
| 206 | C08 | Max | 0.05 | 3.61 | -0.29 | 0.00037 | -0.00030 | 0.00334 |
| 206 | C08 | Min | -0.04 | -3.60 | -0.82 | -0.00037 | -0.00077 | -0.00334 |
| 207 | C08 | Max | 0.05 | 3.78 | -0.26 | 0.00041 | -0.00054 | 0.00306 |
| 207 | C08 | Min | -0.04 | -3.77 | -0.74 | -0.00041 | -0.00148 | -0.00306 |
| 208 | C08 | Max | 0.05 | 4.08 | -0.15 | 0.00024 | -0.00096 | 0.00250 |
| 208 | C08 | Min | -0.05 | -4.07 | -0.43 | -0.00025 | -0.00273 | -0.00252 |
| 209 | C08 | Max | 0.05 | 4.26 | 0.00 | 0.00002 | -0.00112 | 0.00142 |
| 209 | C08 | Min | -0.05 | -4.26 | -0.01 | -0.00002 | -0.00321 | -0.00145 |
| 210 | C08 | Max | 0.02 | 4.26 | 0.00 | 0.00002 | -0.00112 | 0.00141 |
| 210 | C08 | Min | -0.08 | -4.26 | -0.01 | -0.00002 | -0.00321 | -0.00144 |
| 301 | C08 | Max | 10.38 | 3.79 | -0.27 | 0.00005 | -0.00075 | 0.00284 |
| 301 | C08 | Min | -10.56 | -3.78 | -0.75 | -0.00014 | -0.00206 | -0.00284 |
| 302 | C08 | Max | 10.36 | 3.79 | -0.26 | 0.00018 | -0.00075 | 0.00284 |
| 302 | C08 | Min | -10.54 | -3.78 | -0.74 | 0.00000 | -0.00206 | -0.00284 |
| 303 | C08 | Max | 10.38 | 4.09 | -0.15 | 0.00002 | -0.00080 | 0.00284 |
| 303 | C08 | Min | -10.56 | -4.08 | -0.44 | -0.00013 | -0.00221 | -0.00284 |
| 304 | C08 | Max | 10.36 | 4.09 | -0.15 | 0.00016 | -0.00079 | 0.00284 |
| 304 | C08 | Min | -10.54 | -4.08 | -0.43 | 0.00001 | -0.00221 | -0.00284 |
| 401 | C08 | Max | 10.41 | 3.79 | -0.27 | 0.00005 | -0.00075 | 0.00284 |
| 401 | C08 | Min | -10.52 | -3.78 | -0.75 | -0.00014 | -0.00206 | -0.00284 |
| 402 | C08 | Max | 10.39 | 3.79 | -0.26 | 0.00018 | -0.00075 | 0.00284 |
| 402 | C08 | Min | -10.50 | -3.78 | -0.74 | 0.00000 | -0.00206 | -0.00284 |
| 500 | C08 | Max | 12.05 | 5.87 | -0.56 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C08 | Min | -12.23 | -5.86 | -2.43 | 0.00000 | 0.00000 | 0.00000 |

| Case-08: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C08 | Max | 10.35 | 3.93 | -0.21 | 0.00007 | -0.00077 | 0.00284 |
| 501 | C08 | Min | -10.53 | -3.93 | -0.60 | -0.00004 | -0.00215 | -0.00284 |
| 600 | C08 | Max | 12.96 | 6.21 | -0.26 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C08 | Min | -13.14 | -6.20 | -0.72 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C08 | Max | 10.35 | 3.83 | -0.25 | 0.00009 | -0.00075 | 0.00284 |
| 601 | C08 | Min | -10.53 | -3.82 | -0.72 | -0.00005 | -0.00208 | -0.00284 |
| 701 | C08 | Max | 0.01 | 3.79 | -0.27 | 0.00037 | -0.00055 | 0.00305 |
| 701 | C08 | Min | -0.12 | -3.78 | -0.75 | -0.00037 | -0.00149 | -0.00306 |
| 702 | C08 | Max | 0.00 | 3.79 | -0.26 | 0.00041 | -0.00054 | 0.00306 |
| 702 | C08 | Min | -0.11 | -3.78 | -0.74 | -0.00041 | -0.00148 | -0.00306 |
| 703 | C08 | Max | -0.02 | 4.09 | -0.15 | 0.00025 | -0.00098 | 0.00252 |
| 703 | C08 | Min | -0.18 | -4.08 | -0.44 | -0.00024 | -0.00275 | -0.00252 |
| 704 | C08 | Max | -0.03 | 4.09 | -0.15 | 0.00024 | -0.00096 | 0.00250 |
| 704 | C08 | Min | -0.17 | -4.08 | -0.43 | -0.00025 | -0.00273 | -0.00252 |
| 801 | C08 | Max | 0.14 | 2.59 | 0.00 | 0.00001 | 0.00242 | 0.00052 |
| 801 | C08 | Min | 0.02 | -2.58 | 0.00 | -0.00001 | 0.00089 | -0.00052 |
| 802 | C08 | Max | 0.14 | 2.59 | 0.00 | 0.00000 | 0.00240 | 0.00019 |
| 802 | C08 | Min | 0.02 | -2.58 | -0.02 | 0.00000 | 0.00089 | -0.00018 |
| 803 | C08 | Max | 0.13 | 2.59 | 0.00 | 0.00002 | 0.00238 | 0.00056 |
| 803 | C08 | Min | 0.03 | -2.58 | 0.00 | -0.00002 | 0.00088 | -0.00055 |
| 804 | C08 | Max | -0.02 | 4.26 | 0.00 | 0.00001 | -0.00114 | 0.00142 |
| 804 | C08 | Min | -0.18 | -4.26 | -0.01 | -0.00002 | -0.00324 | -0.00140 |
| 805 | C08 | Max | -0.03 | 4.26 | -0.01 | 0.00001 | -0.00113 | 0.00043 |
| 805 | C08 | Min | -0.18 | -4.26 | -0.02 | -0.00001 | -0.00322 | -0.00045 |
| 806 | C08 | Max | -0.03 | 4.27 | 0.00 | 0.00002 | -0.00112 | 0.00139 |
| 806 | C08 | Min | -0.17 | -4.26 | -0.01 | -0.00002 | -0.00321 | -0.00142 |
| | **C08** | **MAX:** | **13.14** | **6.21** | **2.43** | **0.00047** | **0.00380** | **0.00345** |

**Case-09**

| Case-09: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C09 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C09 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C09 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C09 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C09 | Max | 0.00 | 2.73 | 0.00 | -0.00002 | 0.00268 | 0.00073 |
| 10 | C09 | Min | 0.00 | -2.72 | 0.00 | -0.00012 | -0.00095 | -0.00073 |
| 11 | C09 | Max | 0.00 | 2.73 | 0.00 | 0.00011 | 0.00238 | 0.00078 |
| 11 | C09 | Min | 0.00 | -2.72 | 0.00 | 0.00004 | -0.00067 | -0.00078 |
| 12 | C09 | Max | 0.00 | 2.73 | 0.00 | -0.00005 | 0.00222 | 0.00068 |
| 12 | C09 | Min | 0.00 | -2.72 | 0.00 | -0.00009 | -0.00055 | -0.00067 |
| 13 | C09 | Max | 0.00 | 2.73 | 0.00 | 0.00009 | 0.00237 | 0.00063 |
| 13 | C09 | Min | 0.00 | -2.72 | 0.00 | 0.00005 | -0.00071 | -0.00063 |
| 14 | C09 | Max | 0.09 | 4.01 | 0.00 | -0.00021 | -0.00076 | 0.00133 |
| 14 | C09 | Min | -0.09 | -4.01 | 0.00 | -0.00049 | -0.00150 | -0.00133 |
| 15 | C09 | Max | 0.06 | 4.02 | 0.00 | 0.00049 | -0.00076 | 0.00134 |
| 15 | C09 | Min | -0.06 | -4.00 | 0.00 | 0.00021 | -0.00150 | -0.00134 |
| 16 | C09 | Max | 0.07 | 4.01 | 0.00 | -0.00021 | -0.00074 | 0.00132 |
| 16 | C09 | Min | -0.06 | -4.01 | 0.00 | -0.00047 | -0.00150 | -0.00133 |
| 17 | C09 | Max | 0.08 | 4.02 | 0.00 | 0.00048 | -0.00074 | 0.00132 |
| 17 | C09 | Min | -0.07 | -4.00 | 0.00 | 0.00021 | -0.00150 | -0.00133 |
| 21 | C09 | Max | 0.04 | 2.73 | 0.00 | -0.00002 | 0.00267 | 0.00073 |
| 21 | C09 | Min | -0.02 | -2.72 | 0.00 | -0.00012 | -0.00095 | -0.00073 |
| 22 | C09 | Max | 0.04 | 2.73 | 0.00 | 0.00011 | 0.00238 | 0.00078 |
| 22 | C09 | Min | -0.01 | -2.72 | 0.00 | 0.00004 | -0.00067 | -0.00078 |
| 23 | C09 | Max | 0.04 | 2.73 | 0.00 | -0.00005 | 0.00222 | 0.00068 |
| 23 | C09 | Min | -0.01 | -2.72 | 0.00 | -0.00009 | -0.00055 | -0.00067 |
| 24 | C09 | Max | 0.04 | 2.73 | 0.00 | 0.00009 | 0.00237 | 0.00063 |
| 24 | C09 | Min | -0.01 | -2.72 | 0.00 | 0.00005 | -0.00071 | -0.00063 |
| 25 | C09 | Max | 0.07 | 4.01 | 0.00 | -0.00021 | -0.00076 | 0.00133 |
| 25 | C09 | Min | -0.10 | -4.01 | 0.00 | -0.00049 | -0.00150 | -0.00133 |
| 26 | C09 | Max | 0.04 | 4.01 | 0.00 | 0.00049 | -0.00076 | 0.00134 |
| 26 | C09 | Min | -0.07 | -4.01 | 0.00 | 0.00021 | -0.00150 | -0.00134 |
| 27 | C09 | Max | 0.05 | 4.02 | 0.00 | -0.00021 | -0.00074 | 0.00132 |
| 27 | C09 | Min | -0.08 | -4.00 | 0.00 | -0.00047 | -0.00150 | -0.00133 |
| 28 | C09 | Max | 0.06 | 4.02 | 0.00 | 0.00048 | -0.00074 | 0.00132 |
| 28 | C09 | Min | -0.09 | -4.00 | 0.00 | 0.00021 | -0.00150 | -0.00133 |
| 100 | C09 | Max | 0.06 | 2.73 | 0.00 | 0.00000 | 0.00113 | 0.00047 |
| 100 | C09 | Min | -0.03 | -2.72 | 0.00 | -0.00001 | 0.00059 | -0.00047 |
| 101 | C09 | Max | 0.04 | 2.73 | 0.00 | 0.00000 | 0.00113 | 0.00048 |
| 101 | C09 | Min | -0.04 | -2.72 | 0.00 | -0.00001 | 0.00059 | -0.00047 |
| 102 | C09 | Max | 0.05 | 2.79 | -0.08 | 0.00004 | 0.00103 | 0.00153 |
| 102 | C09 | Min | -0.04 | -2.79 | -0.16 | -0.00005 | 0.00054 | -0.00153 |
| 103 | C09 | Max | 0.05 | 2.90 | -0.15 | 0.00008 | 0.00078 | 0.00228 |
| 103 | C09 | Min | -0.05 | -2.90 | -0.29 | -0.00008 | 0.00040 | -0.00228 |
| 104 | C09 | Max | 0.05 | 3.08 | -0.20 | 0.00013 | 0.00028 | 0.00299 |
| 104 | C09 | Min | -0.05 | -3.07 | -0.38 | -0.00013 | 0.00013 | -0.00299 |
| 105 | C09 | Max | 0.05 | 3.13 | -0.20 | 0.00014 | 0.00017 | 0.00308 |

| Case-09: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C09 | Min | -0.05 | -3.13 | -0.39 | -0.00014 | 0.00007 | -0.00308 |
| 106 | C09 | Max | 0.06 | 3.37 | -0.20 | 0.00018 | -0.00017 | 0.00319 |
| 106 | C09 | Min | -0.05 | -3.37 | -0.38 | -0.00018 | -0.00032 | -0.00319 |
| 107 | C09 | Max | 0.06 | 3.53 | -0.17 | 0.00021 | -0.00034 | 0.00306 |
| 107 | C09 | Min | -0.05 | -3.53 | -0.34 | -0.00020 | -0.00064 | -0.00306 |
| 108 | C09 | Max | 0.06 | 3.81 | -0.11 | 0.00025 | -0.00061 | 0.00248 |
| 108 | C09 | Min | -0.06 | -3.81 | -0.22 | -0.00024 | -0.00120 | -0.00248 |
| 109 | C09 | Max | 0.06 | 4.01 | -0.01 | 0.00002 | -0.00076 | 0.00135 |
| 109 | C09 | Min | -0.06 | -4.01 | -0.01 | -0.00002 | -0.00150 | -0.00135 |
| 110 | C09 | Max | 0.04 | 4.01 | -0.01 | 0.00002 | -0.00076 | 0.00134 |
| 110 | C09 | Min | -0.07 | -4.01 | -0.01 | -0.00002 | -0.00150 | -0.00134 |
| 200 | C09 | Max | 0.05 | 2.73 | 0.00 | 0.00001 | 0.00110 | 0.00043 |
| 200 | C09 | Min | -0.02 | -2.72 | 0.00 | -0.00001 | 0.00057 | -0.00043 |
| 201 | C09 | Max | 0.04 | 2.73 | 0.00 | 0.00001 | 0.00110 | 0.00044 |
| 201 | C09 | Min | -0.03 | -2.72 | 0.00 | -0.00001 | 0.00057 | -0.00044 |
| 202 | C09 | Max | 0.04 | 2.78 | -0.08 | 0.00005 | 0.00100 | 0.00147 |
| 202 | C09 | Min | -0.04 | -2.77 | -0.16 | -0.00005 | 0.00052 | -0.00146 |
| 203 | C09 | Max | 0.04 | 2.87 | -0.15 | 0.00009 | 0.00076 | 0.00227 |
| 203 | C09 | Min | -0.04 | -2.86 | -0.28 | -0.00008 | 0.00039 | -0.00226 |
| 204 | C09 | Max | 0.05 | 3.05 | -0.19 | 0.00013 | 0.00029 | 0.00299 |
| 204 | C09 | Min | -0.04 | -3.04 | -0.37 | -0.00013 | 0.00013 | -0.00298 |
| 205 | C09 | Max | 0.05 | 3.11 | -0.20 | 0.00014 | 0.00017 | 0.00307 |
| 205 | C09 | Min | -0.04 | -3.10 | -0.38 | -0.00014 | 0.00007 | -0.00306 |
| 206 | C09 | Max | 0.05 | 3.36 | -0.19 | 0.00018 | -0.00017 | 0.00313 |
| 206 | C09 | Min | -0.05 | -3.35 | -0.38 | -0.00018 | -0.00030 | -0.00312 |
| 207 | C09 | Max | 0.05 | 3.53 | -0.17 | 0.00020 | -0.00033 | 0.00298 |
| 207 | C09 | Min | -0.05 | -3.52 | -0.34 | -0.00020 | -0.00062 | -0.00298 |
| 208 | C09 | Max | 0.05 | 3.82 | -0.11 | 0.00024 | -0.00060 | 0.00241 |
| 208 | C09 | Min | -0.05 | -3.81 | -0.21 | -0.00024 | -0.00118 | -0.00242 |
| 209 | C09 | Max | 0.05 | 4.02 | -0.01 | 0.00001 | -0.00074 | 0.00133 |
| 209 | C09 | Min | -0.05 | -4.00 | -0.01 | -0.00002 | -0.00149 | -0.00134 |
| 210 | C09 | Max | 0.03 | 4.02 | -0.01 | 0.00001 | -0.00074 | 0.00132 |
| 210 | C09 | Min | -0.07 | -4.00 | -0.01 | -0.00001 | -0.00150 | -0.00133 |
| 301 | C09 | Max | 10.33 | 3.82 | -0.11 | -0.00002 | -0.00067 | 0.00196 |
| 301 | C09 | Min | -10.48 | -3.81 | -0.22 | -0.00010 | -0.00132 | -0.00196 |
| 302 | C09 | Max | 10.30 | 3.82 | -0.11 | 0.00012 | -0.00067 | 0.00196 |
| 302 | C09 | Min | -10.45 | -3.81 | -0.21 | 0.00004 | -0.00132 | -0.00196 |
| 303 | C09 | Max | 10.33 | 4.02 | -0.01 | -0.00004 | -0.00073 | 0.00197 |
| 303 | C09 | Min | -10.48 | -4.01 | -0.01 | -0.00010 | -0.00146 | -0.00195 |
| 304 | C09 | Max | 10.30 | 4.01 | -0.01 | 0.00010 | -0.00073 | 0.00195 |
| 304 | C09 | Min | -10.45 | -4.01 | -0.01 | 0.00004 | -0.00146 | -0.00196 |
| 401 | C09 | Max | 10.35 | 3.82 | -0.11 | -0.00002 | -0.00067 | 0.00196 |
| 401 | C09 | Min | -10.45 | -3.81 | -0.22 | -0.00010 | -0.00132 | -0.00196 |
| 402 | C09 | Max | 10.32 | 3.82 | -0.11 | 0.00012 | -0.00067 | 0.00196 |
| 402 | C09 | Min | -10.42 | -3.81 | -0.21 | 0.00004 | -0.00132 | -0.00196 |
| 500 | C09 | Max | 12.05 | 5.32 | -0.55 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C09 | Min | -12.20 | -5.31 | -1.81 | 0.00000 | 0.00000 | 0.00000 |
| 501 | C09 | Max | 10.30 | 3.92 | -0.06 | 0.00001 | -0.00070 | 0.00196 |

| Case-09: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C09 | Min | -10.45 | -3.91 | -0.12 | 0.00000 | -0.00140 | -0.00196 |
| 600 | C09 | Max | 13.51 | 6.03 | -0.10 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C09 | Min | -13.66 | -6.02 | -0.20 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C09 | Max | 10.30 | 3.85 | -0.10 | 0.00003 | -0.00068 | 0.00196 |
| 601 | C09 | Min | -10.45 | -3.84 | -0.20 | -0.00002 | -0.00134 | -0.00196 |
| 701 | C09 | Max | 0.01 | 3.82 | -0.11 | 0.00025 | -0.00061 | 0.00248 |
| 701 | C09 | Min | -0.11 | -3.81 | -0.22 | -0.00024 | -0.00120 | -0.00248 |
| 702 | C09 | Max | 0.00 | 3.82 | -0.11 | 0.00024 | -0.00060 | 0.00241 |
| 702 | C09 | Min | -0.10 | -3.81 | -0.21 | -0.00024 | -0.00118 | -0.00242 |
| 703 | C09 | Max | 0.00 | 4.01 | -0.01 | 0.00003 | -0.00076 | 0.00135 |
| 703 | C09 | Min | -0.12 | -4.01 | -0.01 | -0.00002 | -0.00150 | -0.00135 |
| 704 | C09 | Max | -0.01 | 4.02 | -0.01 | 0.00001 | -0.00074 | 0.00133 |
| 704 | C09 | Min | -0.11 | -4.00 | -0.01 | -0.00002 | -0.00149 | -0.00134 |
| 801 | C09 | Max | 0.09 | 2.73 | 0.00 | 0.00000 | 0.00113 | 0.00046 |
| 801 | C09 | Min | -0.01 | -2.72 | 0.00 | -0.00001 | 0.00059 | -0.00046 |
| 802 | C09 | Max | 0.09 | 2.73 | -0.01 | 0.00000 | 0.00111 | 0.00015 |
| 802 | C09 | Min | 0.00 | -2.72 | -0.01 | 0.00000 | 0.00058 | -0.00013 |
| 803 | C09 | Max | 0.08 | 2.73 | 0.00 | 0.00001 | 0.00110 | 0.00043 |
| 803 | C09 | Min | 0.00 | -2.72 | 0.00 | -0.00001 | 0.00057 | -0.00042 |
| 804 | C09 | Max | 0.01 | 4.01 | -0.01 | 0.00002 | -0.00076 | 0.00132 |
| 804 | C09 | Min | -0.11 | -4.01 | -0.01 | -0.00002 | -0.00150 | -0.00132 |
| 805 | C09 | Max | 0.00 | 4.01 | -0.01 | 0.00001 | -0.00075 | 0.00045 |
| 805 | C09 | Min | -0.11 | -4.01 | -0.02 | -0.00001 | -0.00150 | -0.00045 |
| 806 | C09 | Max | 0.00 | 4.02 | -0.01 | 0.00001 | -0.00074 | 0.00130 |
| 806 | C09 | Min | -0.10 | -4.00 | -0.01 | -0.00001 | -0.00150 | -0.00131 |
| | **C09** | **MAX:** | **13.66** | **6.03** | **1.81** | **0.00049** | **0.00268** | **0.00319** |

## Case-10

| Case-10: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C10 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C10 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C10 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C10 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C10 | Max | 0.00 | 5.20 | 0.00 | -0.00006 | 0.00269 | 0.00074 |
| 10 | C10 | Min | 0.00 | -5.20 | 0.00 | -0.00015 | -0.00013 | -0.00074 |
| 11 | C10 | Max | 0.00 | 5.21 | 0.00 | 0.00014 | 0.00291 | 0.00067 |
| 11 | C10 | Min | 0.00 | -5.20 | 0.00 | 0.00008 | -0.00035 | -0.00067 |
| 12 | C10 | Max | 0.00 | 5.20 | 0.00 | -0.00009 | 0.00267 | 0.00066 |
| 12 | C10 | Min | 0.00 | -5.20 | 0.00 | -0.00013 | -0.00018 | -0.00066 |
| 13 | C10 | Max | 0.00 | 5.21 | 0.00 | 0.00012 | 0.00268 | 0.00066 |
| 13 | C10 | Min | 0.00 | -5.20 | 0.00 | 0.00008 | -0.00021 | -0.00065 |
| 14 | C10 | Max | 0.08 | 5.14 | 0.00 | -0.00006 | -0.00106 | 0.00099 |
| 14 | C10 | Min | -0.07 | -5.14 | 0.00 | -0.00017 | -0.00154 | -0.00100 |
| 15 | C10 | Max | 0.06 | 5.14 | 0.00 | 0.00015 | -0.00106 | 0.00098 |
| 15 | C10 | Min | -0.05 | -5.14 | 0.00 | 0.00008 | -0.00154 | -0.00100 |
| 16 | C10 | Max | 0.06 | 5.14 | 0.00 | -0.00009 | -0.00102 | 0.00099 |
| 16 | C10 | Min | -0.06 | -5.14 | 0.00 | -0.00013 | -0.00149 | -0.00101 |
| 17 | C10 | Max | 0.07 | 5.14 | 0.00 | 0.00013 | -0.00102 | 0.00098 |
| 17 | C10 | Min | -0.06 | -5.14 | 0.00 | 0.00009 | -0.00149 | -0.00100 |
| 21 | C10 | Max | 0.04 | 5.21 | 0.00 | -0.00006 | 0.00269 | 0.00074 |
| 21 | C10 | Min | 0.00 | -5.20 | 0.00 | -0.00015 | -0.00013 | -0.00074 |
| 22 | C10 | Max | 0.05 | 5.21 | 0.00 | 0.00014 | 0.00291 | 0.00067 |
| 22 | C10 | Min | -0.01 | -5.20 | 0.00 | 0.00008 | -0.00035 | -0.00067 |
| 23 | C10 | Max | 0.04 | 5.21 | 0.00 | -0.00009 | 0.00267 | 0.00066 |
| 23 | C10 | Min | 0.00 | -5.20 | 0.00 | -0.00013 | -0.00018 | -0.00066 |
| 24 | C10 | Max | 0.04 | 5.21 | 0.00 | 0.00012 | 0.00268 | 0.00066 |
| 24 | C10 | Min | 0.00 | -5.20 | 0.00 | 0.00008 | -0.00021 | -0.00065 |
| 25 | C10 | Max | 0.06 | 5.14 | 0.00 | -0.00006 | -0.00106 | 0.00099 |
| 25 | C10 | Min | -0.09 | -5.14 | 0.00 | -0.00017 | -0.00154 | -0.00100 |
| 26 | C10 | Max | 0.04 | 5.14 | 0.00 | 0.00015 | -0.00106 | 0.00098 |
| 26 | C10 | Min | -0.07 | -5.14 | 0.00 | 0.00008 | -0.00154 | -0.00100 |
| 27 | C10 | Max | 0.04 | 5.14 | 0.00 | -0.00009 | -0.00102 | 0.00099 |
| 27 | C10 | Min | -0.08 | -5.14 | 0.00 | -0.00013 | -0.00149 | -0.00101 |
| 28 | C10 | Max | 0.05 | 5.14 | 0.00 | 0.00013 | -0.00102 | 0.00098 |
| 28 | C10 | Min | -0.08 | -5.14 | 0.00 | 0.00009 | -0.00149 | -0.00100 |
| 100 | C10 | Max | 0.06 | 5.21 | 0.00 | 0.00001 | 0.00152 | 0.00049 |
| 100 | C10 | Min | -0.02 | -5.20 | 0.00 | -0.00002 | 0.00104 | -0.00048 |
| 101 | C10 | Max | 0.04 | 5.21 | 0.00 | 0.00002 | 0.00152 | 0.00050 |
| 101 | C10 | Min | -0.04 | -5.20 | 0.00 | -0.00002 | 0.00104 | -0.00049 |
| 102 | C10 | Max | 0.04 | 5.24 | -0.15 | 0.00029 | 0.00137 | 0.00151 |
| 102 | C10 | Min | -0.04 | -5.24 | -0.22 | -0.00030 | 0.00094 | -0.00151 |
| 103 | C10 | Max | 0.05 | 5.30 | -0.26 | 0.00056 | 0.00099 | 0.00163 |
| 103 | C10 | Min | -0.04 | -5.29 | -0.38 | -0.00056 | 0.00068 | -0.00164 |
| 104 | C10 | Max | 0.05 | 5.35 | -0.34 | 0.00089 | 0.00021 | 0.00061 |
| 104 | C10 | Min | -0.05 | -5.34 | -0.49 | -0.00089 | 0.00014 | -0.00061 |

| Case-10: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C10 | Max | 0.05 | 5.35 | -0.34 | 0.00088 | 0.00003 | 0.00032 |
| 105 | C10 | Min | -0.05 | -5.34 | -0.50 | -0.00088 | -0.00001 | -0.00032 |
| 106 | C10 | Max | 0.05 | 5.32 | -0.32 | 0.00084 | -0.00037 | 0.00086 |
| 106 | C10 | Min | -0.05 | -5.32 | -0.47 | -0.00084 | -0.00055 | -0.00087 |
| 107 | C10 | Max | 0.05 | 5.28 | -0.27 | 0.00062 | -0.00068 | 0.00151 |
| 107 | C10 | Min | -0.05 | -5.27 | -0.39 | -0.00062 | -0.00099 | -0.00151 |
| 108 | C10 | Max | 0.05 | 5.20 | -0.15 | 0.00033 | -0.00096 | 0.00166 |
| 108 | C10 | Min | -0.05 | -5.20 | -0.22 | -0.00033 | -0.00139 | -0.00167 |
| 109 | C10 | Max | 0.06 | 5.14 | 0.00 | 0.00002 | -0.00106 | 0.00099 |
| 109 | C10 | Min | -0.05 | -5.14 | 0.00 | -0.00002 | -0.00154 | -0.00100 |
| 110 | C10 | Max | 0.04 | 5.14 | 0.00 | 0.00002 | -0.00106 | 0.00098 |
| 110 | C10 | Min | -0.07 | -5.14 | 0.00 | -0.00002 | -0.00154 | -0.00100 |
| 200 | C10 | Max | 0.06 | 5.21 | 0.00 | 0.00002 | 0.00147 | 0.00049 |
| 200 | C10 | Min | -0.02 | -5.20 | 0.00 | -0.00001 | 0.00101 | -0.00048 |
| 201 | C10 | Max | 0.04 | 5.21 | 0.00 | 0.00002 | 0.00147 | 0.00049 |
| 201 | C10 | Min | -0.03 | -5.20 | 0.00 | -0.00001 | 0.00101 | -0.00049 |
| 202 | C10 | Max | 0.04 | 5.24 | -0.14 | 0.00029 | 0.00133 | 0.00151 |
| 202 | C10 | Min | -0.04 | -5.24 | -0.21 | -0.00028 | 0.00091 | -0.00150 |
| 203 | C10 | Max | 0.04 | 5.30 | -0.25 | 0.00055 | 0.00096 | 0.00163 |
| 203 | C10 | Min | -0.04 | -5.29 | -0.37 | -0.00054 | 0.00066 | -0.00163 |
| 204 | C10 | Max | 0.05 | 5.35 | -0.33 | 0.00087 | 0.00020 | 0.00060 |
| 204 | C10 | Min | -0.04 | -5.34 | -0.48 | -0.00087 | 0.00013 | -0.00060 |
| 205 | C10 | Max | 0.05 | 5.35 | -0.33 | 0.00086 | 0.00003 | 0.00031 |
| 205 | C10 | Min | -0.04 | -5.34 | -0.48 | -0.00086 | -0.00001 | -0.00032 |
| 206 | C10 | Max | 0.05 | 5.33 | -0.31 | 0.00082 | -0.00036 | 0.00085 |
| 206 | C10 | Min | -0.04 | -5.32 | -0.45 | -0.00081 | -0.00053 | -0.00086 |
| 207 | C10 | Max | 0.05 | 5.28 | -0.26 | 0.00061 | -0.00066 | 0.00149 |
| 207 | C10 | Min | -0.05 | -5.27 | -0.37 | -0.00060 | -0.00096 | -0.00150 |
| 208 | C10 | Max | 0.05 | 5.20 | -0.15 | 0.00032 | -0.00092 | 0.00165 |
| 208 | C10 | Min | -0.05 | -5.20 | -0.21 | -0.00031 | -0.00134 | -0.00167 |
| 209 | C10 | Max | 0.05 | 5.14 | 0.00 | 0.00002 | -0.00102 | 0.00099 |
| 209 | C10 | Min | -0.05 | -5.14 | 0.00 | -0.00002 | -0.00149 | -0.00101 |
| 210 | C10 | Max | 0.03 | 5.14 | 0.00 | 0.00002 | -0.00102 | 0.00099 |
| 210 | C10 | Min | -0.07 | -5.14 | 0.00 | -0.00002 | -0.00149 | -0.00100 |
| 301 | C10 | Max | 11.90 | 5.36 | -0.34 | 0.00006 | -0.00010 | 0.00029 |
| 301 | C10 | Min | -11.89 | -5.36 | -0.49 | -0.00002 | -0.00017 | -0.00029 |
| 302 | C10 | Max | 11.90 | 5.36 | -0.33 | 0.00013 | -0.00010 | 0.00029 |
| 302 | C10 | Min | -11.88 | -5.36 | -0.48 | 0.00005 | -0.00017 | -0.00029 |
| 303 | C10 | Max | 11.90 | 5.34 | -0.32 | 0.00007 | -0.00013 | 0.00029 |
| 303 | C10 | Min | -11.89 | -5.34 | -0.47 | -0.00001 | -0.00020 | -0.00030 |
| 304 | C10 | Max | 11.90 | 5.34 | -0.31 | 0.00011 | -0.00013 | 0.00029 |
| 304 | C10 | Min | -11.88 | -5.34 | -0.45 | 0.00004 | -0.00020 | -0.00030 |
| 401 | C10 | Max | 11.91 | 5.36 | -0.34 | 0.00006 | -0.00010 | 0.00029 |
| 401 | C10 | Min | -11.88 | -5.36 | -0.49 | -0.00002 | -0.00017 | -0.00029 |
| 402 | C10 | Max | 11.90 | 5.37 | -0.33 | 0.00013 | -0.00010 | 0.00029 |
| 402 | C10 | Min | -11.88 | -5.36 | -0.48 | 0.00005 | -0.00017 | -0.00029 |
| 500 | C10 | Max | 11.58 | 7.85 | -0.33 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C10 | Min | -11.57 | -7.85 | -0.48 | 0.00000 | 0.00000 | 0.00000 |

| Case-10: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C10 | Max | 11.90 | 5.35 | -0.33 | 0.00009 | -0.00012 | 0.00029 |
| 501 | C10 | Min | -11.89 | -5.35 | -0.47 | 0.00002 | -0.00019 | -0.00029 |
| 600 | C10 | Max | 11.66 | 7.59 | -0.37 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C10 | Min | -11.64 | -7.58 | -0.54 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C10 | Max | 11.90 | 5.36 | -0.33 | 0.00009 | -0.00011 | 0.00029 |
| 601 | C10 | Min | -11.89 | -5.36 | -0.48 | 0.00002 | -0.00017 | -0.00029 |
| 701 | C10 | Max | 0.06 | 5.36 | -0.34 | 0.00089 | 0.00021 | 0.00061 |
| 701 | C10 | Min | -0.04 | -5.36 | -0.49 | -0.00089 | 0.00014 | -0.00061 |
| 702 | C10 | Max | 0.06 | 5.37 | -0.33 | 0.00088 | 0.00020 | 0.00060 |
| 702 | C10 | Min | -0.03 | -5.36 | -0.48 | -0.00088 | 0.00013 | -0.00060 |
| 703 | C10 | Max | 0.03 | 5.34 | -0.32 | 0.00084 | -0.00037 | 0.00086 |
| 703 | C10 | Min | -0.07 | -5.34 | -0.47 | -0.00084 | -0.00055 | -0.00087 |
| 704 | C10 | Max | 0.02 | 5.34 | -0.31 | 0.00082 | -0.00036 | 0.00085 |
| 704 | C10 | Min | -0.07 | -5.33 | -0.45 | -0.00081 | -0.00053 | -0.00086 |
| 801 | C10 | Max | 0.11 | 5.21 | 0.00 | 0.00001 | 0.00152 | 0.00048 |
| 801 | C10 | Min | 0.02 | -5.20 | 0.00 | -0.00002 | 0.00104 | -0.00047 |
| 802 | C10 | Max | 0.10 | 5.21 | -0.01 | 0.00001 | 0.00150 | 0.00030 |
| 802 | C10 | Min | 0.02 | -5.20 | -0.01 | -0.00001 | 0.00102 | -0.00028 |
| 803 | C10 | Max | 0.10 | 5.21 | 0.00 | 0.00002 | 0.00147 | 0.00048 |
| 803 | C10 | Min | 0.02 | -5.20 | 0.00 | -0.00001 | 0.00101 | -0.00047 |
| 804 | C10 | Max | -0.01 | 5.14 | 0.00 | 0.00002 | -0.00106 | 0.00097 |
| 804 | C10 | Min | -0.11 | -5.14 | 0.00 | -0.00002 | -0.00154 | -0.00098 |
| 805 | C10 | Max | -0.01 | 5.14 | -0.01 | 0.00001 | -0.00105 | 0.00037 |
| 805 | C10 | Min | -0.11 | -5.14 | -0.01 | -0.00001 | -0.00151 | -0.00038 |
| 806 | C10 | Max | -0.01 | 5.14 | 0.00 | 0.00002 | -0.00102 | 0.00097 |
| 806 | C10 | Min | -0.10 | -5.14 | 0.00 | -0.00002 | -0.00149 | -0.00099 |
| | **C10** | **MAX:** | **11.91** | **7.85** | **0.54** | **0.00089** | **0.00291** | **0.00167** |

**Case-11**

| Case-11: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C11 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C11 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C11 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C11 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C11 | Max | 0.00 | 2.28 | 0.00 | -0.00002 | 0.00266 | 0.00073 |
| 10 | C11 | Min | 0.00 | -2.28 | 0.00 | -0.00013 | -0.00082 | -0.00073 |
| 11 | C11 | Max | 0.00 | 2.29 | 0.00 | 0.00012 | 0.00247 | 0.00080 |
| 11 | C11 | Min | 0.00 | -2.28 | 0.00 | 0.00004 | -0.00064 | -0.00080 |
| 12 | C11 | Max | 0.00 | 2.29 | 0.00 | -0.00005 | 0.00227 | 0.00068 |
| 12 | C11 | Min | 0.00 | -2.28 | 0.00 | -0.00010 | -0.00048 | -0.00068 |
| 13 | C11 | Max | 0.00 | 2.29 | 0.00 | 0.00010 | 0.00246 | 0.00065 |
| 13 | C11 | Min | 0.00 | -2.28 | 0.00 | 0.00005 | -0.00068 | -0.00064 |
| 14 | C11 | Max | 0.10 | 3.96 | 0.00 | -0.00010 | -0.00091 | 0.00141 |
| 14 | C11 | Min | -0.09 | -3.96 | 0.00 | -0.00019 | -0.00135 | -0.00142 |
| 15 | C11 | Max | 0.06 | 3.97 | 0.00 | 0.00019 | -0.00091 | 0.00142 |
| 15 | C11 | Min | -0.05 | -3.96 | 0.00 | 0.00011 | -0.00135 | -0.00142 |
| 16 | C11 | Max | 0.06 | 3.96 | 0.00 | -0.00011 | -0.00087 | 0.00140 |
| 16 | C11 | Min | -0.06 | -3.96 | 0.00 | -0.00017 | -0.00133 | -0.00142 |
| 17 | C11 | Max | 0.08 | 3.97 | 0.00 | 0.00017 | -0.00087 | 0.00140 |
| 17 | C11 | Min | -0.08 | -3.96 | 0.00 | 0.00011 | -0.00133 | -0.00142 |
| 21 | C11 | Max | 0.04 | 2.29 | 0.00 | -0.00002 | 0.00266 | 0.00073 |
| 21 | C11 | Min | -0.01 | -2.28 | 0.00 | -0.00013 | -0.00082 | -0.00073 |
| 22 | C11 | Max | 0.04 | 2.29 | 0.00 | 0.00012 | 0.00247 | 0.00080 |
| 22 | C11 | Min | -0.01 | -2.28 | 0.00 | 0.00004 | -0.00064 | -0.00080 |
| 23 | C11 | Max | 0.04 | 2.29 | 0.00 | -0.00005 | 0.00227 | 0.00068 |
| 23 | C11 | Min | -0.01 | -2.28 | 0.00 | -0.00010 | -0.00048 | -0.00068 |
| 24 | C11 | Max | 0.04 | 2.29 | 0.00 | 0.00010 | 0.00246 | 0.00065 |
| 24 | C11 | Min | -0.01 | -2.28 | 0.00 | 0.00005 | -0.00068 | -0.00064 |
| 25 | C11 | Max | 0.08 | 3.96 | 0.00 | -0.00010 | -0.00091 | 0.00141 |
| 25 | C11 | Min | -0.11 | -3.96 | 0.00 | -0.00019 | -0.00135 | -0.00142 |
| 26 | C11 | Max | 0.04 | 3.96 | 0.00 | 0.00019 | -0.00091 | 0.00142 |
| 26 | C11 | Min | -0.07 | -3.96 | 0.00 | 0.00011 | -0.00135 | -0.00142 |
| 27 | C11 | Max | 0.04 | 3.96 | 0.00 | -0.00011 | -0.00087 | 0.00140 |
| 27 | C11 | Min | -0.08 | -3.96 | 0.00 | -0.00017 | -0.00133 | -0.00142 |
| 28 | C11 | Max | 0.07 | 3.96 | 0.00 | 0.00017 | -0.00087 | 0.00140 |
| 28 | C11 | Min | -0.09 | -3.96 | 0.00 | 0.00011 | -0.00133 | -0.00142 |
| 100 | C11 | Max | 0.06 | 2.29 | 0.00 | 0.00001 | 0.00110 | 0.00054 |
| 100 | C11 | Min | -0.03 | -2.28 | 0.00 | -0.00001 | 0.00073 | -0.00054 |
| 101 | C11 | Max | 0.04 | 2.29 | 0.00 | 0.00001 | 0.00110 | 0.00055 |
| 101 | C11 | Min | -0.04 | -2.28 | 0.00 | -0.00001 | 0.00073 | -0.00055 |
| 102 | C11 | Max | 0.05 | 2.39 | -0.11 | 0.00008 | 0.00100 | 0.00180 |
| 102 | C11 | Min | -0.04 | -2.39 | -0.16 | -0.00008 | 0.00067 | -0.00180 |
| 103 | C11 | Max | 0.05 | 2.58 | -0.19 | 0.00015 | 0.00074 | 0.00264 |
| 103 | C11 | Min | -0.05 | -2.58 | -0.28 | -0.00015 | 0.00050 | -0.00265 |
| 104 | C11 | Max | 0.05 | 2.90 | -0.25 | 0.00024 | 0.00026 | 0.00331 |
| 104 | C11 | Min | -0.05 | -2.90 | -0.37 | -0.00024 | 0.00016 | -0.00331 |

| Case-11: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C11 | Max | 0.05 | 2.98 | -0.25 | 0.00026 | 0.00014 | 0.00338 |
| 105 | C11 | Min | -0.05 | -2.97 | -0.37 | -0.00026 | 0.00007 | -0.00338 |
| 106 | C11 | Max | 0.05 | 3.30 | -0.24 | 0.00033 | -0.00025 | 0.00328 |
| 106 | C11 | Min | -0.05 | -3.30 | -0.36 | -0.00033 | -0.00039 | -0.00328 |
| 107 | C11 | Max | 0.06 | 3.48 | -0.22 | 0.00036 | -0.00045 | 0.00303 |
| 107 | C11 | Min | -0.05 | -3.47 | -0.32 | -0.00036 | -0.00068 | -0.00303 |
| 108 | C11 | Max | 0.06 | 3.79 | -0.12 | 0.00025 | -0.00079 | 0.00250 |
| 108 | C11 | Min | -0.05 | -3.78 | -0.18 | -0.00025 | -0.00116 | -0.00250 |
| 109 | C11 | Max | 0.06 | 3.96 | 0.00 | 0.00001 | -0.00091 | 0.00142 |
| 109 | C11 | Min | -0.06 | -3.96 | 0.00 | -0.00002 | -0.00135 | -0.00142 |
| 110 | C11 | Max | 0.04 | 3.96 | 0.00 | 0.00001 | -0.00091 | 0.00141 |
| 110 | C11 | Min | -0.07 | -3.96 | 0.00 | -0.00002 | -0.00135 | -0.00141 |
| 200 | C11 | Max | 0.05 | 2.29 | 0.00 | 0.00002 | 0.00107 | 0.00056 |
| 200 | C11 | Min | -0.02 | -2.28 | 0.00 | -0.00002 | 0.00071 | -0.00055 |
| 201 | C11 | Max | 0.04 | 2.29 | 0.00 | 0.00002 | 0.00107 | 0.00057 |
| 201 | C11 | Min | -0.03 | -2.28 | 0.00 | -0.00002 | 0.00071 | -0.00056 |
| 202 | C11 | Max | 0.04 | 2.39 | -0.10 | 0.00009 | 0.00098 | 0.00183 |
| 202 | C11 | Min | -0.04 | -2.38 | -0.15 | -0.00009 | 0.00065 | -0.00183 |
| 203 | C11 | Max | 0.04 | 2.59 | -0.18 | 0.00017 | 0.00073 | 0.00265 |
| 203 | C11 | Min | -0.04 | -2.59 | -0.27 | -0.00017 | 0.00048 | -0.00265 |
| 204 | C11 | Max | 0.04 | 2.91 | -0.24 | 0.00027 | 0.00026 | 0.00332 |
| 204 | C11 | Min | -0.04 | -2.91 | -0.36 | -0.00027 | 0.00016 | -0.00332 |
| 205 | C11 | Max | 0.05 | 2.98 | -0.24 | 0.00029 | 0.00014 | 0.00339 |
| 205 | C11 | Min | -0.04 | -2.98 | -0.37 | -0.00029 | 0.00008 | -0.00339 |
| 206 | C11 | Max | 0.05 | 3.30 | -0.23 | 0.00037 | -0.00025 | 0.00329 |
| 206 | C11 | Min | -0.04 | -3.30 | -0.35 | -0.00037 | -0.00038 | -0.00330 |
| 207 | C11 | Max | 0.05 | 3.48 | -0.21 | 0.00041 | -0.00044 | 0.00303 |
| 207 | C11 | Min | -0.05 | -3.47 | -0.31 | -0.00041 | -0.00067 | -0.00303 |
| 208 | C11 | Max | 0.05 | 3.79 | -0.12 | 0.00025 | -0.00076 | 0.00249 |
| 208 | C11 | Min | -0.05 | -3.78 | -0.18 | -0.00025 | -0.00115 | -0.00250 |
| 209 | C11 | Max | 0.05 | 3.96 | 0.00 | 0.00002 | -0.00087 | 0.00141 |
| 209 | C11 | Min | -0.05 | -3.96 | 0.00 | -0.00001 | -0.00133 | -0.00142 |
| 210 | C11 | Max | 0.03 | 3.96 | 0.00 | 0.00002 | -0.00087 | 0.00140 |
| 210 | C11 | Min | -0.06 | -3.96 | 0.00 | -0.00001 | -0.00133 | -0.00141 |
| 301 | C11 | Max | 11.86 | 3.49 | -0.22 | 0.00007 | -0.00061 | 0.00280 |
| 301 | C11 | Min | -11.95 | -3.49 | -0.32 | -0.00009 | -0.00092 | -0.00280 |
| 302 | C11 | Max | 11.96 | 3.49 | -0.21 | 0.00013 | -0.00061 | 0.00280 |
| 302 | C11 | Min | -12.06 | -3.49 | -0.31 | -0.00002 | -0.00092 | -0.00280 |
| 303 | C11 | Max | 11.86 | 3.79 | -0.12 | 0.00004 | -0.00064 | 0.00280 |
| 303 | C11 | Min | -11.95 | -3.79 | -0.18 | -0.00006 | -0.00096 | -0.00280 |
| 304 | C11 | Max | 11.96 | 3.79 | -0.12 | 0.00009 | -0.00064 | 0.00280 |
| 304 | C11 | Min | -12.06 | -3.79 | -0.18 | -0.00001 | -0.00096 | -0.00280 |
| 401 | C11 | Max | 11.87 | 3.49 | -0.22 | 0.00007 | -0.00061 | 0.00280 |
| 401 | C11 | Min | -11.93 | -3.48 | -0.32 | -0.00009 | -0.00092 | -0.00280 |
| 402 | C11 | Max | 11.98 | 3.49 | -0.21 | 0.00013 | -0.00061 | 0.00280 |
| 402 | C11 | Min | -12.04 | -3.48 | -0.31 | -0.00002 | -0.00092 | -0.00280 |
| 500 | C11 | Max | 11.45 | 5.64 | -0.17 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C11 | Min | -11.55 | -5.63 | -0.26 | 0.00000 | 0.00000 | 0.00000 |

| Case-11: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C11 | Max | 11.91 | 3.64 | -0.17 | 0.00007 | -0.00063 | 0.00280 |
| 501 | C11 | Min | -12.00 | -3.64 | -0.25 | -0.00004 | -0.00094 | -0.00280 |
| 600 | C11 | Max | 11.40 | 5.23 | -0.24 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C11 | Min | -11.50 | -5.23 | -0.36 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C11 | Max | 11.91 | 3.53 | -0.20 | 0.00009 | -0.00062 | 0.00280 |
| 601 | C11 | Min | -12.00 | -3.52 | -0.30 | -0.00005 | -0.00092 | -0.00280 |
| 701 | C11 | Max | 0.02 | 3.49 | -0.22 | 0.00037 | -0.00045 | 0.00303 |
| 701 | C11 | Min | -0.08 | -3.48 | -0.32 | -0.00037 | -0.00068 | -0.00303 |
| 702 | C11 | Max | 0.02 | 3.49 | -0.21 | 0.00041 | -0.00044 | 0.00303 |
| 702 | C11 | Min | -0.08 | -3.48 | -0.31 | -0.00041 | -0.00067 | -0.00303 |
| 703 | C11 | Max | 0.00 | 3.79 | -0.12 | 0.00025 | -0.00079 | 0.00250 |
| 703 | C11 | Min | -0.11 | -3.79 | -0.18 | -0.00025 | -0.00116 | -0.00250 |
| 704 | C11 | Max | 0.00 | 3.79 | -0.12 | 0.00025 | -0.00076 | 0.00249 |
| 704 | C11 | Min | -0.10 | -3.79 | -0.18 | -0.00025 | -0.00115 | -0.00250 |
| 801 | C11 | Max | 0.09 | 2.29 | 0.00 | 0.00001 | 0.00110 | 0.00053 |
| 801 | C11 | Min | 0.00 | -2.28 | 0.00 | -0.00001 | 0.00073 | -0.00053 |
| 802 | C11 | Max | 0.09 | 2.29 | -0.01 | 0.00000 | 0.00108 | 0.00020 |
| 802 | C11 | Min | 0.00 | -2.28 | -0.02 | 0.00000 | 0.00073 | -0.00018 |
| 803 | C11 | Max | 0.08 | 2.29 | 0.00 | 0.00002 | 0.00107 | 0.00055 |
| 803 | C11 | Min | 0.01 | -2.28 | 0.00 | -0.00002 | 0.00071 | -0.00054 |
| 804 | C11 | Max | 0.01 | 3.96 | 0.00 | 0.00001 | -0.00091 | 0.00139 |
| 804 | C11 | Min | -0.11 | -3.96 | 0.00 | -0.00002 | -0.00135 | -0.00139 |
| 805 | C11 | Max | 0.00 | 3.96 | -0.01 | 0.00001 | -0.00089 | 0.00044 |
| 805 | C11 | Min | -0.10 | -3.96 | -0.02 | -0.00001 | -0.00133 | -0.00045 |
| 806 | C11 | Max | 0.00 | 3.96 | 0.00 | 0.00002 | -0.00087 | 0.00138 |
| 806 | C11 | Min | -0.10 | -3.96 | 0.00 | -0.00001 | -0.00133 | -0.00139 |
| | **C11** | **MAX:** | **12.06** | **5.64** | **0.37** | **0.00041** | **0.00266** | **0.00339** |

## Case-12

| Case-12: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C12 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C12 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C12 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C12 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C12 | Max | 0.00 | 2.58 | 0.00 | -0.00001 | 0.00233 | 0.00073 |
| 10 | C12 | Min | 0.00 | -2.57 | 0.00 | -0.00010 | -0.00111 | -0.00073 |
| 11 | C12 | Max | 0.00 | 2.58 | 0.00 | 0.00009 | 0.00208 | 0.00079 |
| 11 | C12 | Min | 0.00 | -2.57 | 0.00 | 0.00003 | -0.00087 | -0.00079 |
| 12 | C12 | Max | 0.00 | 2.58 | 0.00 | -0.00004 | 0.00190 | 0.00067 |
| 12 | C12 | Min | 0.00 | -2.58 | 0.00 | -0.00007 | -0.00072 | -0.00067 |
| 13 | C12 | Max | 0.00 | 2.58 | 0.00 | 0.00007 | 0.00204 | 0.00063 |
| 13 | C12 | Min | 0.00 | -2.57 | 0.00 | 0.00004 | -0.00088 | -0.00063 |
| 14 | C12 | Max | 0.09 | 3.88 | 0.00 | -0.00012 | -0.00059 | 0.00140 |
| 14 | C12 | Min | -0.09 | -3.88 | 0.00 | -0.00021 | -0.00088 | -0.00139 |
| 15 | C12 | Max | 0.06 | 3.89 | 0.00 | 0.00021 | -0.00059 | 0.00139 |
| 15 | C12 | Min | -0.06 | -3.88 | 0.00 | 0.00012 | -0.00088 | -0.00139 |
| 16 | C12 | Max | 0.07 | 3.88 | 0.00 | -0.00013 | -0.00058 | 0.00138 |
| 16 | C12 | Min | -0.06 | -3.88 | 0.00 | -0.00019 | -0.00087 | -0.00139 |
| 17 | C12 | Max | 0.08 | 3.89 | 0.00 | 0.00019 | -0.00058 | 0.00138 |
| 17 | C12 | Min | -0.08 | -3.88 | 0.00 | 0.00013 | -0.00087 | -0.00139 |
| 21 | C12 | Max | 0.04 | 2.58 | 0.00 | -0.00001 | 0.00233 | 0.00073 |
| 21 | C12 | Min | -0.02 | -2.57 | 0.00 | -0.00010 | -0.00111 | -0.00073 |
| 22 | C12 | Max | 0.03 | 2.58 | 0.00 | 0.00009 | 0.00208 | 0.00079 |
| 22 | C12 | Min | -0.01 | -2.57 | 0.00 | 0.00003 | -0.00087 | -0.00079 |
| 23 | C12 | Max | 0.03 | 2.58 | 0.00 | -0.00004 | 0.00190 | 0.00067 |
| 23 | C12 | Min | -0.01 | -2.57 | 0.00 | -0.00007 | -0.00072 | -0.00067 |
| 24 | C12 | Max | 0.03 | 2.58 | 0.00 | 0.00007 | 0.00204 | 0.00063 |
| 24 | C12 | Min | -0.01 | -2.57 | 0.00 | 0.00004 | -0.00088 | -0.00063 |
| 25 | C12 | Max | 0.08 | 3.88 | 0.00 | -0.00012 | -0.00059 | 0.00140 |
| 25 | C12 | Min | -0.10 | -3.88 | 0.00 | -0.00021 | -0.00088 | -0.00139 |
| 26 | C12 | Max | 0.05 | 3.88 | 0.00 | 0.00021 | -0.00059 | 0.00139 |
| 26 | C12 | Min | -0.07 | -3.88 | 0.00 | 0.00012 | -0.00088 | -0.00139 |
| 27 | C12 | Max | 0.05 | 3.89 | 0.00 | -0.00013 | -0.00058 | 0.00138 |
| 27 | C12 | Min | -0.07 | -3.88 | 0.00 | -0.00019 | -0.00087 | -0.00139 |
| 28 | C12 | Max | 0.07 | 3.89 | 0.00 | 0.00019 | -0.00058 | 0.00138 |
| 28 | C12 | Min | -0.09 | -3.88 | 0.00 | 0.00013 | -0.00087 | -0.00139 |
| 100 | C12 | Max | 0.05 | 2.58 | 0.00 | 0.00000 | 0.00073 | 0.00047 |
| 100 | C12 | Min | -0.03 | -2.57 | 0.00 | -0.00001 | 0.00049 | -0.00047 |
| 101 | C12 | Max | 0.04 | 2.58 | 0.00 | 0.00000 | 0.00073 | 0.00048 |
| 101 | C12 | Min | -0.04 | -2.57 | 0.00 | -0.00001 | 0.00049 | -0.00048 |
| 102 | C12 | Max | 0.05 | 2.63 | -0.07 | 0.00004 | 0.00066 | 0.00156 |
| 102 | C12 | Min | -0.04 | -2.63 | -0.10 | -0.00005 | 0.00044 | -0.00156 |
| 103 | C12 | Max | 0.05 | 2.78 | -0.12 | 0.00008 | 0.00048 | 0.00233 |
| 103 | C12 | Min | -0.05 | -2.78 | -0.18 | -0.00008 | 0.00032 | -0.00233 |
| 104 | C12 | Max | 0.05 | 3.06 | -0.16 | 0.00013 | 0.00015 | 0.00306 |
| 104 | C12 | Min | -0.05 | -3.05 | -0.24 | -0.00013 | 0.00009 | -0.00307 |
| 105 | C12 | Max | 0.05 | 3.12 | -0.16 | 0.00014 | 0.00007 | 0.00317 |

| Case-12: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C12 | Min | -0.05 | -3.12 | -0.24 | -0.00014 | 0.00003 | -0.00317 |
| 106 | C12 | Max | 0.06 | 3.33 | -0.16 | 0.00018 | -0.00015 | 0.00330 |
| 106 | C12 | Min | -0.05 | -3.33 | -0.23 | -0.00018 | -0.00024 | -0.00330 |
| 107 | C12 | Max | 0.06 | 3.46 | -0.14 | 0.00020 | -0.00028 | 0.00316 |
| 107 | C12 | Min | -0.05 | -3.46 | -0.21 | -0.00020 | -0.00042 | -0.00316 |
| 108 | C12 | Max | 0.06 | 3.68 | -0.08 | 0.00024 | -0.00049 | 0.00257 |
| 108 | C12 | Min | -0.06 | -3.68 | -0.13 | -0.00024 | -0.00073 | -0.00257 |
| 109 | C12 | Max | 0.06 | 3.88 | 0.00 | 0.00002 | -0.00059 | 0.00140 |
| 109 | C12 | Min | -0.06 | -3.88 | 0.00 | -0.00002 | -0.00088 | -0.00140 |
| 110 | C12 | Max | 0.05 | 3.88 | 0.00 | 0.00002 | -0.00059 | 0.00139 |
| 110 | C12 | Min | -0.07 | -3.88 | 0.00 | -0.00002 | -0.00088 | -0.00139 |
| 200 | C12 | Max | 0.05 | 2.58 | 0.00 | 0.00002 | 0.00070 | 0.00046 |
| 200 | C12 | Min | -0.03 | -2.57 | 0.00 | -0.00001 | 0.00046 | -0.00045 |
| 201 | C12 | Max | 0.04 | 2.58 | 0.00 | 0.00002 | 0.00070 | 0.00046 |
| 201 | C12 | Min | -0.04 | -2.57 | 0.00 | -0.00001 | 0.00046 | -0.00046 |
| 202 | C12 | Max | 0.04 | 2.62 | -0.07 | 0.00005 | 0.00063 | 0.00153 |
| 202 | C12 | Min | -0.04 | -2.61 | -0.10 | -0.00005 | 0.00042 | -0.00152 |
| 203 | C12 | Max | 0.04 | 2.76 | -0.12 | 0.00009 | 0.00046 | 0.00233 |
| 203 | C12 | Min | -0.04 | -2.75 | -0.18 | -0.00009 | 0.00031 | -0.00233 |
| 204 | C12 | Max | 0.05 | 3.03 | -0.15 | 0.00014 | 0.00015 | 0.00306 |
| 204 | C12 | Min | -0.04 | -3.02 | -0.23 | -0.00013 | 0.00010 | -0.00305 |
| 205 | C12 | Max | 0.05 | 3.09 | -0.16 | 0.00015 | 0.00007 | 0.00315 |
| 205 | C12 | Min | -0.04 | -3.08 | -0.24 | -0.00014 | 0.00004 | -0.00315 |
| 206 | C12 | Max | 0.05 | 3.31 | -0.15 | 0.00018 | -0.00014 | 0.00322 |
| 206 | C12 | Min | -0.05 | -3.31 | -0.23 | -0.00018 | -0.00022 | -0.00322 |
| 207 | C12 | Max | 0.05 | 3.45 | -0.13 | 0.00020 | -0.00027 | 0.00308 |
| 207 | C12 | Min | -0.05 | -3.44 | -0.20 | -0.00020 | -0.00041 | -0.00308 |
| 208 | C12 | Max | 0.05 | 3.68 | -0.08 | 0.00024 | -0.00047 | 0.00251 |
| 208 | C12 | Min | -0.05 | -3.67 | -0.12 | -0.00024 | -0.00071 | -0.00252 |
| 209 | C12 | Max | 0.05 | 3.89 | 0.00 | 0.00001 | -0.00058 | 0.00139 |
| 209 | C12 | Min | -0.05 | -3.88 | 0.00 | -0.00001 | -0.00087 | -0.00140 |
| 210 | C12 | Max | 0.04 | 3.89 | 0.00 | 0.00001 | -0.00058 | 0.00138 |
| 210 | C12 | Min | -0.06 | -3.88 | 0.00 | -0.00001 | -0.00087 | -0.00139 |
| 301 | C12 | Max | 12.11 | 3.69 | -0.08 | 0.00001 | -0.00054 | 0.00204 |
| 301 | C12 | Min | -12.21 | -3.68 | -0.13 | -0.00005 | -0.00081 | -0.00204 |
| 302 | C12 | Max | 12.19 | 3.69 | -0.08 | 0.00007 | -0.00054 | 0.00204 |
| 302 | C12 | Min | -12.28 | -3.68 | -0.12 | 0.00001 | -0.00081 | -0.00204 |
| 303 | C12 | Max | 12.11 | 3.89 | 0.00 | -0.00001 | -0.00057 | 0.00204 |
| 303 | C12 | Min | -12.21 | -3.88 | 0.00 | -0.00003 | -0.00085 | -0.00204 |
| 304 | C12 | Max | 12.19 | 3.89 | 0.00 | 0.00003 | -0.00057 | 0.00203 |
| 304 | C12 | Min | -12.28 | -3.88 | 0.00 | 0.00001 | -0.00084 | -0.00203 |
| 401 | C12 | Max | 12.13 | 3.69 | -0.08 | 0.00001 | -0.00054 | 0.00204 |
| 401 | C12 | Min | -12.19 | -3.68 | -0.13 | -0.00005 | -0.00081 | -0.00204 |
| 402 | C12 | Max | 12.20 | 3.69 | -0.08 | 0.00007 | -0.00054 | 0.00204 |
| 402 | C12 | Min | -12.27 | -3.68 | -0.12 | 0.00001 | -0.00081 | -0.00204 |
| 500 | C12 | Max | 11.81 | 5.67 | -0.05 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C12 | Min | -11.91 | -5.67 | -0.07 | 0.00000 | 0.00000 | 0.00000 |
| 501 | C12 | Max | 12.15 | 3.79 | -0.05 | 0.00001 | -0.00056 | 0.00204 |

| Case-12: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C12 | Min | -12.25 | -3.78 | -0.07 | 0.00000 | -0.00083 | -0.00203 |
| 600 | C12 | Max | 11.76 | 5.28 | -0.11 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C12 | Min | -11.86 | -5.27 | -0.17 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C12 | Max | 12.15 | 3.71 | -0.08 | 0.00003 | -0.00055 | 0.00204 |
| 601 | C12 | Min | -12.25 | -3.71 | -0.11 | -0.00002 | -0.00081 | -0.00204 |
| 701 | C12 | Max | 0.02 | 3.69 | -0.08 | 0.00024 | -0.00049 | 0.00257 |
| 701 | C12 | Min | -0.09 | -3.68 | -0.13 | -0.00024 | -0.00073 | -0.00257 |
| 702 | C12 | Max | 0.02 | 3.69 | -0.08 | 0.00024 | -0.00047 | 0.00251 |
| 702 | C12 | Min | -0.08 | -3.68 | -0.12 | -0.00024 | -0.00071 | -0.00252 |
| 703 | C12 | Max | 0.02 | 3.89 | 0.00 | 0.00002 | -0.00059 | 0.00140 |
| 703 | C12 | Min | -0.10 | -3.88 | 0.00 | -0.00002 | -0.00088 | -0.00140 |
| 704 | C12 | Max | 0.01 | 3.89 | 0.00 | 0.00001 | -0.00058 | 0.00139 |
| 704 | C12 | Min | -0.09 | -3.88 | 0.00 | -0.00001 | -0.00087 | -0.00140 |
| 801 | C12 | Max | 0.07 | 2.58 | 0.00 | 0.00000 | 0.00073 | 0.00047 |
| 801 | C12 | Min | -0.01 | -2.57 | 0.00 | -0.00001 | 0.00049 | -0.00046 |
| 802 | C12 | Max | 0.07 | 2.58 | -0.01 | 0.00000 | 0.00071 | 0.00015 |
| 802 | C12 | Min | -0.01 | -2.57 | -0.01 | 0.00000 | 0.00048 | -0.00014 |
| 803 | C12 | Max | 0.07 | 2.58 | 0.00 | 0.00002 | 0.00070 | 0.00045 |
| 803 | C12 | Min | -0.01 | -2.57 | 0.00 | -0.00001 | 0.00046 | -0.00044 |
| 804 | C12 | Max | 0.02 | 3.89 | 0.00 | 0.00002 | -0.00059 | 0.00137 |
| 804 | C12 | Min | -0.09 | -3.88 | 0.00 | -0.00002 | -0.00088 | -0.00137 |
| 805 | C12 | Max | 0.02 | 3.89 | -0.01 | 0.00001 | -0.00059 | 0.00044 |
| 805 | C12 | Min | -0.09 | -3.88 | -0.02 | -0.00001 | -0.00087 | -0.00045 |
| 806 | C12 | Max | 0.02 | 3.89 | 0.00 | 0.00001 | -0.00058 | 0.00136 |
| 806 | C12 | Min | -0.08 | -3.88 | 0.00 | -0.00001 | -0.00087 | -0.00137 |
| | **C12** | **MAX:** | **12.28** | **5.67** | **0.24** | **0.00024** | **0.00233** | **0.00330** |

## Case-13

| Case-13: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C13 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C13 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C13 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C13 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C13 | Max | 0.00 | 5.35 | 0.00 | -0.00007 | 0.00271 | 0.00074 |
| 10 | C13 | Min | 0.00 | -5.35 | 0.00 | -0.00015 | -0.00015 | -0.00074 |
| 11 | C13 | Max | 0.00 | 5.36 | 0.00 | 0.00015 | 0.00294 | 0.00068 |
| 11 | C13 | Min | 0.00 | -5.35 | 0.00 | 0.00007 | -0.00039 | -0.00068 |
| 12 | C13 | Max | 0.00 | 5.35 | 0.00 | -0.00008 | 0.00272 | 0.00066 |
| 12 | C13 | Min | 0.00 | -5.35 | 0.00 | -0.00013 | -0.00022 | -0.00065 |
| 13 | C13 | Max | 0.00 | 5.36 | 0.00 | 0.00013 | 0.00266 | 0.00067 |
| 13 | C13 | Min | 0.00 | -5.35 | 0.00 | 0.00008 | -0.00019 | -0.00067 |
| 14 | C13 | Max | 0.08 | 5.31 | 0.00 | -0.00006 | -0.00102 | 0.00099 |
| 14 | C13 | Min | -0.07 | -5.31 | 0.00 | -0.00016 | -0.00158 | -0.00100 |
| 15 | C13 | Max | 0.06 | 5.31 | 0.00 | 0.00015 | -0.00102 | 0.00099 |
| 15 | C13 | Min | -0.05 | -5.31 | 0.00 | 0.00008 | -0.00158 | -0.00100 |
| 16 | C13 | Max | 0.06 | 5.31 | 0.00 | -0.00009 | -0.00098 | 0.00098 |
| 16 | C13 | Min | -0.06 | -5.31 | 0.00 | -0.00013 | -0.00153 | -0.00100 |
| 17 | C13 | Max | 0.07 | 5.32 | 0.00 | 0.00014 | -0.00098 | 0.00098 |
| 17 | C13 | Min | -0.06 | -5.31 | 0.00 | 0.00008 | -0.00153 | -0.00099 |
| 21 | C13 | Max | 0.04 | 5.35 | 0.00 | -0.00007 | 0.00271 | 0.00074 |
| 21 | C13 | Min | 0.00 | -5.35 | 0.00 | -0.00015 | -0.00015 | -0.00074 |
| 22 | C13 | Max | 0.05 | 5.35 | 0.00 | 0.00015 | 0.00294 | 0.00068 |
| 22 | C13 | Min | -0.01 | -5.35 | 0.00 | 0.00007 | -0.00039 | -0.00068 |
| 23 | C13 | Max | 0.04 | 5.36 | 0.00 | -0.00008 | 0.00272 | 0.00066 |
| 23 | C13 | Min | 0.00 | -5.35 | 0.00 | -0.00013 | -0.00022 | -0.00065 |
| 24 | C13 | Max | 0.04 | 5.36 | 0.00 | 0.00013 | 0.00266 | 0.00067 |
| 24 | C13 | Min | 0.00 | -5.35 | 0.00 | 0.00008 | -0.00019 | -0.00067 |
| 25 | C13 | Max | 0.06 | 5.31 | 0.00 | -0.00006 | -0.00102 | 0.00099 |
| 25 | C13 | Min | -0.09 | -5.31 | 0.00 | -0.00016 | -0.00158 | -0.00100 |
| 26 | C13 | Max | 0.04 | 5.31 | 0.00 | 0.00015 | -0.00102 | 0.00099 |
| 26 | C13 | Min | -0.08 | -5.31 | 0.00 | 0.00008 | -0.00158 | -0.00100 |
| 27 | C13 | Max | 0.04 | 5.31 | 0.00 | -0.00009 | -0.00098 | 0.00098 |
| 27 | C13 | Min | -0.08 | -5.31 | 0.00 | -0.00013 | -0.00153 | -0.00100 |
| 28 | C13 | Max | 0.05 | 5.31 | 0.00 | 0.00014 | -0.00098 | 0.00098 |
| 28 | C13 | Min | -0.08 | -5.31 | 0.00 | 0.00008 | -0.00153 | -0.00099 |
| 100 | C13 | Max | 0.06 | 5.35 | 0.00 | 0.00001 | 0.00156 | 0.00050 |
| 100 | C13 | Min | -0.02 | -5.35 | 0.00 | -0.00002 | 0.00100 | -0.00050 |
| 101 | C13 | Max | 0.04 | 5.35 | 0.00 | 0.00001 | 0.00156 | 0.00051 |
| 101 | C13 | Min | -0.04 | -5.35 | 0.00 | -0.00002 | 0.00100 | -0.00051 |
| 102 | C13 | Max | 0.04 | 5.40 | -0.14 | 0.00029 | 0.00141 | 0.00157 |
| 102 | C13 | Min | -0.04 | -5.39 | -0.22 | -0.00029 | 0.00091 | -0.00157 |
| 103 | C13 | Max | 0.05 | 5.45 | -0.25 | 0.00055 | 0.00101 | 0.00170 |
| 103 | C13 | Min | -0.04 | -5.45 | -0.39 | -0.00055 | 0.00065 | -0.00171 |
| 104 | C13 | Max | 0.05 | 5.52 | -0.32 | 0.00087 | 0.00021 | 0.00066 |
| 104 | C13 | Min | -0.05 | -5.51 | -0.50 | -0.00087 | 0.00013 | -0.00066 |

| Case-13: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C13 | Max | 0.05 | 5.52 | -0.33 | 0.00086 | 0.00003 | 0.00035 |
| 105 | C13 | Min | -0.05 | -5.51 | -0.51 | -0.00086 | -0.00001 | -0.00035 |
| 106 | C13 | Max | 0.05 | 5.50 | -0.31 | 0.00082 | -0.00036 | 0.00084 |
| 106 | C13 | Min | -0.05 | -5.49 | -0.48 | -0.00082 | -0.00056 | -0.00084 |
| 107 | C13 | Max | 0.05 | 5.44 | -0.26 | 0.00061 | -0.00065 | 0.00148 |
| 107 | C13 | Min | -0.05 | -5.44 | -0.40 | -0.00061 | -0.00101 | -0.00148 |
| 108 | C13 | Max | 0.06 | 5.37 | -0.15 | 0.00032 | -0.00092 | 0.00165 |
| 108 | C13 | Min | -0.05 | -5.37 | -0.23 | -0.00032 | -0.00142 | -0.00166 |
| 109 | C13 | Max | 0.06 | 5.31 | 0.00 | 0.00002 | -0.00102 | 0.00100 |
| 109 | C13 | Min | -0.05 | -5.31 | 0.00 | -0.00002 | -0.00158 | -0.00101 |
| 110 | C13 | Max | 0.04 | 5.31 | 0.00 | 0.00002 | -0.00102 | 0.00099 |
| 110 | C13 | Min | -0.07 | -5.31 | 0.00 | -0.00002 | -0.00158 | -0.00100 |
| 200 | C13 | Max | 0.06 | 5.36 | 0.00 | 0.00002 | 0.00151 | 0.00051 |
| 200 | C13 | Min | -0.02 | -5.35 | 0.00 | -0.00001 | 0.00097 | -0.00050 |
| 201 | C13 | Max | 0.04 | 5.36 | 0.00 | 0.00002 | 0.00151 | 0.00052 |
| 201 | C13 | Min | -0.03 | -5.35 | 0.00 | -0.00001 | 0.00097 | -0.00051 |
| 202 | C13 | Max | 0.04 | 5.40 | -0.14 | 0.00029 | 0.00137 | 0.00157 |
| 202 | C13 | Min | -0.04 | -5.39 | -0.22 | -0.00028 | 0.00088 | -0.00156 |
| 203 | C13 | Max | 0.04 | 5.46 | -0.24 | 0.00055 | 0.00098 | 0.00170 |
| 203 | C13 | Min | -0.04 | -5.45 | -0.38 | -0.00054 | 0.00063 | -0.00170 |
| 204 | C13 | Max | 0.05 | 5.52 | -0.31 | 0.00087 | 0.00021 | 0.00065 |
| 204 | C13 | Min | -0.04 | -5.51 | -0.49 | -0.00087 | 0.00013 | -0.00066 |
| 205 | C13 | Max | 0.05 | 5.52 | -0.32 | 0.00086 | 0.00002 | 0.00034 |
| 205 | C13 | Min | -0.04 | -5.51 | -0.49 | -0.00086 | -0.00001 | -0.00035 |
| 206 | C13 | Max | 0.05 | 5.50 | -0.30 | 0.00081 | -0.00035 | 0.00083 |
| 206 | C13 | Min | -0.04 | -5.49 | -0.46 | -0.00081 | -0.00055 | -0.00084 |
| 207 | C13 | Max | 0.05 | 5.45 | -0.25 | 0.00060 | -0.00063 | 0.00146 |
| 207 | C13 | Min | -0.05 | -5.44 | -0.38 | -0.00060 | -0.00098 | -0.00147 |
| 208 | C13 | Max | 0.05 | 5.37 | -0.14 | 0.00032 | -0.00089 | 0.00164 |
| 208 | C13 | Min | -0.05 | -5.37 | -0.22 | -0.00031 | -0.00138 | -0.00166 |
| 209 | C13 | Max | 0.05 | 5.31 | 0.00 | 0.00002 | -0.00098 | 0.00098 |
| 209 | C13 | Min | -0.05 | -5.31 | 0.00 | -0.00002 | -0.00153 | -0.00100 |
| 210 | C13 | Max | 0.03 | 5.31 | 0.00 | 0.00002 | -0.00098 | 0.00098 |
| 210 | C13 | Min | -0.07 | -5.31 | 0.00 | -0.00002 | -0.00153 | -0.00099 |
| 301 | C13 | Max | 11.23 | 5.54 | -0.32 | 0.00007 | -0.00010 | 0.00031 |
| 301 | C13 | Min | -11.22 | -5.53 | -0.50 | -0.00003 | -0.00017 | -0.00031 |
| 302 | C13 | Max | 11.23 | 5.54 | -0.31 | 0.00014 | -0.00009 | 0.00030 |
| 302 | C13 | Min | -11.21 | -5.53 | -0.49 | 0.00004 | -0.00017 | -0.00031 |
| 303 | C13 | Max | 11.23 | 5.51 | -0.31 | 0.00008 | -0.00013 | 0.00031 |
| 303 | C13 | Min | -11.22 | -5.51 | -0.48 | -0.00002 | -0.00021 | -0.00032 |
| 304 | C13 | Max | 11.23 | 5.51 | -0.30 | 0.00012 | -0.00012 | 0.00031 |
| 304 | C13 | Min | -11.21 | -5.51 | -0.46 | 0.00003 | -0.00021 | -0.00032 |
| 401 | C13 | Max | 11.24 | 5.54 | -0.32 | 0.00007 | -0.00010 | 0.00031 |
| 401 | C13 | Min | -11.21 | -5.53 | -0.50 | -0.00003 | -0.00017 | -0.00031 |
| 402 | C13 | Max | 11.23 | 5.54 | -0.31 | 0.00014 | -0.00009 | 0.00030 |
| 402 | C13 | Min | -11.21 | -5.53 | -0.49 | 0.00004 | -0.00017 | -0.00031 |
| 500 | C13 | Max | 13.23 | 8.44 | -0.32 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C13 | Min | -13.21 | -8.44 | -0.49 | 0.00000 | 0.00000 | 0.00000 |

| Case-13: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C13 | Max | 11.23 | 5.53 | -0.31 | 0.00010 | -0.00011 | 0.00031 |
| 501 | C13 | Min | -11.21 | -5.52 | -0.49 | 0.00000 | -0.00020 | -0.00031 |
| 600 | C13 | Max | 16.06 | 8.05 | -0.63 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C13 | Min | -16.04 | -8.05 | -1.26 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C13 | Max | 11.23 | 5.53 | -0.32 | 0.00010 | -0.00010 | 0.00031 |
| 601 | C13 | Min | -11.21 | -5.53 | -0.50 | 0.00000 | -0.00018 | -0.00031 |
| 701 | C13 | Max | 0.06 | 5.54 | -0.32 | 0.00087 | 0.00022 | 0.00066 |
| 701 | C13 | Min | -0.04 | -5.53 | -0.50 | -0.00087 | 0.00013 | -0.00066 |
| 702 | C13 | Max | 0.06 | 5.54 | -0.31 | 0.00088 | 0.00021 | 0.00065 |
| 702 | C13 | Min | -0.03 | -5.53 | -0.49 | -0.00087 | 0.00013 | -0.00066 |
| 703 | C13 | Max | 0.03 | 5.51 | -0.31 | 0.00082 | -0.00036 | 0.00084 |
| 703 | C13 | Min | -0.07 | -5.51 | -0.48 | -0.00082 | -0.00056 | -0.00084 |
| 704 | C13 | Max | 0.02 | 5.52 | -0.30 | 0.00081 | -0.00035 | 0.00083 |
| 704 | C13 | Min | -0.07 | -5.51 | -0.46 | -0.00081 | -0.00055 | -0.00084 |
| 801 | C13 | Max | 0.11 | 5.35 | 0.00 | 0.00001 | 0.00156 | 0.00049 |
| 801 | C13 | Min | 0.02 | -5.35 | 0.00 | -0.00002 | 0.00100 | -0.00049 |
| 802 | C13 | Max | 0.10 | 5.35 | -0.01 | 0.00001 | 0.00153 | 0.00030 |
| 802 | C13 | Min | 0.02 | -5.35 | -0.02 | -0.00001 | 0.00099 | -0.00028 |
| 803 | C13 | Max | 0.10 | 5.36 | 0.00 | 0.00002 | 0.00151 | 0.00050 |
| 803 | C13 | Min | 0.02 | -5.35 | 0.00 | -0.00001 | 0.00097 | -0.00049 |
| 804 | C13 | Max | 0.00 | 5.31 | 0.00 | 0.00002 | -0.00102 | 0.00098 |
| 804 | C13 | Min | -0.11 | -5.31 | 0.00 | -0.00002 | -0.00158 | -0.00099 |
| 805 | C13 | Max | 0.00 | 5.31 | -0.01 | 0.00001 | -0.00100 | 0.00037 |
| 805 | C13 | Min | -0.11 | -5.31 | -0.02 | -0.00001 | -0.00155 | -0.00039 |
| 806 | C13 | Max | -0.01 | 5.31 | 0.00 | 0.00002 | -0.00098 | 0.00096 |
| 806 | C13 | Min | -0.11 | -5.31 | 0.00 | -0.00002 | -0.00153 | -0.00098 |
| | **C13** | **MAX:** | **16.06** | **8.44** | **1.26** | **0.00088** | **0.00294** | **0.00171** |

## Case-14

| Case-14: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C14 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C14 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C14 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C14 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C14 | Max | 0.00 | 2.42 | 0.00 | -0.00002 | 0.00266 | 0.00074 |
| 10 | C14 | Min | 0.00 | -2.42 | 0.00 | -0.00013 | -0.00083 | -0.00074 |
| 11 | C14 | Max | 0.00 | 2.42 | 0.00 | 0.00012 | 0.00245 | 0.00081 |
| 11 | C14 | Min | 0.00 | -2.42 | 0.00 | 0.00003 | -0.00063 | -0.00081 |
| 12 | C14 | Max | 0.00 | 2.42 | 0.00 | -0.00005 | 0.00228 | 0.00069 |
| 12 | C14 | Min | 0.00 | -2.42 | 0.00 | -0.00010 | -0.00050 | -0.00069 |
| 13 | C14 | Max | 0.00 | 2.43 | 0.00 | 0.00010 | 0.00247 | 0.00064 |
| 13 | C14 | Min | 0.00 | -2.42 | 0.00 | 0.00005 | -0.00069 | -0.00064 |
| 14 | C14 | Max | 0.10 | 4.15 | 0.00 | -0.00009 | -0.00092 | 0.00142 |
| 14 | C14 | Min | -0.09 | -4.15 | 0.00 | -0.00020 | -0.00133 | -0.00142 |
| 15 | C14 | Max | 0.06 | 4.16 | 0.00 | 0.00019 | -0.00092 | 0.00142 |
| 15 | C14 | Min | -0.05 | -4.15 | 0.00 | 0.00010 | -0.00133 | -0.00142 |
| 16 | C14 | Max | 0.06 | 4.15 | 0.00 | -0.00011 | -0.00090 | 0.00141 |
| 16 | C14 | Min | -0.06 | -4.16 | 0.00 | -0.00017 | -0.00130 | -0.00142 |
| 17 | C14 | Max | 0.08 | 4.16 | 0.00 | 0.00017 | -0.00090 | 0.00141 |
| 17 | C14 | Min | -0.08 | -4.15 | 0.00 | 0.00011 | -0.00130 | -0.00142 |
| 21 | C14 | Max | 0.04 | 2.42 | 0.00 | -0.00002 | 0.00266 | 0.00074 |
| 21 | C14 | Min | -0.01 | -2.42 | 0.00 | -0.00013 | -0.00083 | -0.00074 |
| 22 | C14 | Max | 0.04 | 2.42 | 0.00 | 0.00012 | 0.00245 | 0.00081 |
| 22 | C14 | Min | -0.01 | -2.42 | 0.00 | 0.00003 | -0.00063 | -0.00081 |
| 23 | C14 | Max | 0.04 | 2.42 | 0.00 | -0.00005 | 0.00228 | 0.00069 |
| 23 | C14 | Min | -0.01 | -2.42 | 0.00 | -0.00010 | -0.00050 | -0.00069 |
| 24 | C14 | Max | 0.04 | 2.42 | 0.00 | 0.00010 | 0.00247 | 0.00064 |
| 24 | C14 | Min | -0.01 | -2.42 | 0.00 | 0.00005 | -0.00069 | -0.00064 |
| 25 | C14 | Max | 0.08 | 4.16 | 0.00 | -0.00009 | -0.00092 | 0.00142 |
| 25 | C14 | Min | -0.11 | -4.15 | 0.00 | -0.00020 | -0.00133 | -0.00142 |
| 26 | C14 | Max | 0.04 | 4.16 | 0.00 | 0.00019 | -0.00092 | 0.00142 |
| 26 | C14 | Min | -0.07 | -4.15 | 0.00 | 0.00010 | -0.00133 | -0.00142 |
| 27 | C14 | Max | 0.04 | 4.16 | 0.00 | -0.00011 | -0.00090 | 0.00141 |
| 27 | C14 | Min | -0.08 | -4.15 | 0.00 | -0.00017 | -0.00130 | -0.00142 |
| 28 | C14 | Max | 0.07 | 4.16 | 0.00 | 0.00017 | -0.00090 | 0.00141 |
| 28 | C14 | Min | -0.10 | -4.15 | 0.00 | 0.00011 | -0.00130 | -0.00142 |
| 100 | C14 | Max | 0.06 | 2.42 | 0.00 | 0.00001 | 0.00108 | 0.00054 |
| 100 | C14 | Min | -0.03 | -2.42 | 0.00 | -0.00001 | 0.00075 | -0.00054 |
| 101 | C14 | Max | 0.04 | 2.42 | 0.00 | 0.00001 | 0.00108 | 0.00055 |
| 101 | C14 | Min | -0.04 | -2.42 | 0.00 | -0.00001 | 0.00075 | -0.00055 |
| 102 | C14 | Max | 0.05 | 2.54 | -0.11 | 0.00008 | 0.00098 | 0.00180 |
| 102 | C14 | Min | -0.04 | -2.54 | -0.16 | -0.00009 | 0.00069 | -0.00180 |
| 103 | C14 | Max | 0.05 | 2.75 | -0.19 | 0.00016 | 0.00073 | 0.00263 |
| 103 | C14 | Min | -0.05 | -2.74 | -0.27 | -0.00016 | 0.00052 | -0.00263 |
| 104 | C14 | Max | 0.05 | 3.07 | -0.25 | 0.00025 | 0.00026 | 0.00333 |
| 104 | C14 | Min | -0.05 | -3.07 | -0.36 | -0.00025 | 0.00016 | -0.00333 |

| Case-14: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C14 | Max | 0.05 | 3.14 | -0.26 | 0.00027 | 0.00014 | 0.00341 |
| 105 | C14 | Min | -0.05 | -3.14 | -0.37 | -0.00027 | 0.00007 | -0.00342 |
| 106 | C14 | Max | 0.05 | 3.48 | -0.25 | 0.00035 | -0.00025 | 0.00333 |
| 106 | C14 | Min | -0.05 | -3.47 | -0.35 | -0.00035 | -0.00039 | -0.00334 |
| 107 | C14 | Max | 0.06 | 3.66 | -0.22 | 0.00039 | -0.00046 | 0.00303 |
| 107 | C14 | Min | -0.05 | -3.66 | -0.31 | -0.00039 | -0.00067 | -0.00303 |
| 108 | C14 | Max | 0.06 | 3.97 | -0.13 | 0.00025 | -0.00081 | 0.00251 |
| 108 | C14 | Min | -0.05 | -3.97 | -0.18 | -0.00025 | -0.00114 | -0.00251 |
| 109 | C14 | Max | 0.06 | 4.16 | 0.00 | 0.00002 | -0.00092 | 0.00143 |
| 109 | C14 | Min | -0.06 | -4.15 | 0.00 | -0.00002 | -0.00133 | -0.00143 |
| 110 | C14 | Max | 0.04 | 4.16 | 0.00 | 0.00002 | -0.00092 | 0.00142 |
| 110 | C14 | Min | -0.07 | -4.15 | 0.00 | -0.00002 | -0.00133 | -0.00142 |
| 200 | C14 | Max | 0.05 | 2.42 | 0.00 | 0.00002 | 0.00105 | 0.00056 |
| 200 | C14 | Min | -0.02 | -2.42 | 0.00 | -0.00002 | 0.00073 | -0.00056 |
| 201 | C14 | Max | 0.04 | 2.43 | 0.00 | 0.00002 | 0.00105 | 0.00057 |
| 201 | C14 | Min | -0.03 | -2.42 | 0.00 | -0.00002 | 0.00073 | -0.00057 |
| 202 | C14 | Max | 0.04 | 2.54 | -0.10 | 0.00010 | 0.00096 | 0.00183 |
| 202 | C14 | Min | -0.04 | -2.53 | -0.15 | -0.00009 | 0.00067 | -0.00182 |
| 203 | C14 | Max | 0.04 | 2.74 | -0.19 | 0.00017 | 0.00071 | 0.00264 |
| 203 | C14 | Min | -0.04 | -2.73 | -0.27 | -0.00017 | 0.00050 | -0.00264 |
| 204 | C14 | Max | 0.05 | 3.06 | -0.25 | 0.00027 | 0.00026 | 0.00330 |
| 204 | C14 | Min | -0.04 | -3.06 | -0.35 | -0.00027 | 0.00016 | -0.00330 |
| 205 | C14 | Max | 0.05 | 3.14 | -0.25 | 0.00029 | 0.00015 | 0.00338 |
| 205 | C14 | Min | -0.04 | -3.13 | -0.36 | -0.00029 | 0.00007 | -0.00338 |
| 206 | C14 | Max | 0.05 | 3.48 | -0.24 | 0.00036 | -0.00025 | 0.00330 |
| 206 | C14 | Min | -0.04 | -3.48 | -0.34 | -0.00036 | -0.00038 | -0.00330 |
| 207 | C14 | Max | 0.05 | 3.66 | -0.22 | 0.00040 | -0.00046 | 0.00302 |
| 207 | C14 | Min | -0.05 | -3.66 | -0.31 | -0.00040 | -0.00065 | -0.00303 |
| 208 | C14 | Max | 0.05 | 3.98 | -0.12 | 0.00024 | -0.00079 | 0.00250 |
| 208 | C14 | Min | -0.05 | -3.97 | -0.17 | -0.00024 | -0.00112 | -0.00251 |
| 209 | C14 | Max | 0.05 | 4.16 | 0.00 | 0.00002 | -0.00090 | 0.00142 |
| 209 | C14 | Min | -0.05 | -4.15 | 0.00 | -0.00002 | -0.00130 | -0.00143 |
| 210 | C14 | Max | 0.03 | 4.16 | 0.00 | 0.00002 | -0.00090 | 0.00141 |
| 210 | C14 | Min | -0.06 | -4.15 | 0.00 | -0.00001 | -0.00130 | -0.00142 |
| 301 | C14 | Max | 11.18 | 3.67 | -0.22 | 0.00006 | -0.00063 | 0.00282 |
| 301 | C14 | Min | -11.27 | -3.67 | -0.31 | -0.00008 | -0.00090 | -0.00282 |
| 302 | C14 | Max | 11.29 | 3.67 | -0.22 | 0.00013 | -0.00063 | 0.00282 |
| 302 | C14 | Min | -11.38 | -3.67 | -0.31 | -0.00002 | -0.00090 | -0.00282 |
| 303 | C14 | Max | 11.18 | 3.98 | -0.13 | 0.00004 | -0.00067 | 0.00282 |
| 303 | C14 | Min | -11.27 | -3.98 | -0.18 | -0.00006 | -0.00093 | -0.00283 |
| 304 | C14 | Max | 11.29 | 3.98 | -0.12 | 0.00009 | -0.00066 | 0.00282 |
| 304 | C14 | Min | -11.38 | -3.98 | -0.17 | -0.00002 | -0.00093 | -0.00282 |
| 401 | C14 | Max | 11.19 | 3.67 | -0.22 | 0.00006 | -0.00063 | 0.00282 |
| 401 | C14 | Min | -11.25 | -3.67 | -0.31 | -0.00008 | -0.00090 | -0.00282 |
| 402 | C14 | Max | 11.30 | 3.67 | -0.22 | 0.00013 | -0.00063 | 0.00282 |
| 402 | C14 | Min | -11.36 | -3.67 | -0.31 | -0.00002 | -0.00090 | -0.00282 |
| 500 | C14 | Max | 12.81 | 6.37 | -0.18 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C14 | Min | -12.91 | -6.37 | -0.25 | 0.00000 | 0.00000 | 0.00000 |

| Case-14: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C14 | Max | 11.23 | 3.82 | -0.17 | 0.00007 | -0.00065 | 0.00282 |
| 501 | C14 | Min | -11.33 | -3.82 | -0.25 | -0.00004 | -0.00092 | -0.00282 |
| 600 | C14 | Max | 16.01 | 6.12 | -0.56 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C14 | Min | -16.10 | -6.11 | -1.02 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C14 | Max | 11.23 | 3.71 | -0.21 | 0.00009 | -0.00064 | 0.00282 |
| 601 | C14 | Min | -11.33 | -3.71 | -0.29 | -0.00005 | -0.00090 | -0.00282 |
| 701 | C14 | Max | 0.02 | 3.67 | -0.22 | 0.00039 | -0.00046 | 0.00303 |
| 701 | C14 | Min | -0.08 | -3.67 | -0.31 | -0.00039 | -0.00067 | -0.00303 |
| 702 | C14 | Max | 0.02 | 3.67 | -0.22 | 0.00041 | -0.00045 | 0.00302 |
| 702 | C14 | Min | -0.08 | -3.67 | -0.31 | -0.00040 | -0.00065 | -0.00303 |
| 703 | C14 | Max | 0.00 | 3.98 | -0.13 | 0.00026 | -0.00081 | 0.00251 |
| 703 | C14 | Min | -0.11 | -3.98 | -0.18 | -0.00025 | -0.00114 | -0.00251 |
| 704 | C14 | Max | 0.00 | 3.98 | -0.12 | 0.00024 | -0.00079 | 0.00250 |
| 704 | C14 | Min | -0.10 | -3.98 | -0.17 | -0.00024 | -0.00112 | -0.00251 |
| 801 | C14 | Max | 0.09 | 2.42 | 0.00 | 0.00001 | 0.00108 | 0.00053 |
| 801 | C14 | Min | 0.00 | -2.42 | 0.00 | -0.00001 | 0.00075 | -0.00053 |
| 802 | C14 | Max | 0.09 | 2.42 | 0.00 | 0.00000 | 0.00106 | 0.00019 |
| 802 | C14 | Min | 0.00 | -2.42 | -0.02 | 0.00000 | 0.00074 | -0.00018 |
| 803 | C14 | Max | 0.08 | 2.42 | 0.00 | 0.00002 | 0.00105 | 0.00056 |
| 803 | C14 | Min | 0.01 | -2.42 | 0.00 | -0.00002 | 0.00073 | -0.00055 |
| 804 | C14 | Max | 0.01 | 4.16 | 0.00 | 0.00002 | -0.00092 | 0.00140 |
| 804 | C14 | Min | -0.11 | -4.15 | 0.00 | -0.00002 | -0.00133 | -0.00140 |
| 805 | C14 | Max | 0.00 | 4.16 | 0.00 | 0.00001 | -0.00093 | 0.00044 |
| 805 | C14 | Min | -0.10 | -4.15 | -0.02 | -0.00001 | -0.00130 | -0.00045 |
| 806 | C14 | Max | 0.00 | 4.16 | 0.00 | 0.00002 | -0.00090 | 0.00138 |
| 806 | C14 | Min | -0.10 | -4.15 | 0.00 | -0.00002 | -0.00130 | -0.00140 |
| | **C14** | **MAX:** | **16.10** | **6.37** | **1.02** | **0.00041** | **0.00266** | **0.00342** |

## Case-15

| Case-15: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 1 | C15 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 1 | C15 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C15 | Max | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 2 | C15 | Min | 0.00 | 0.00 | 0.00 | 0.00000 | 0.00000 | 0.00000 |
| 10 | C15 | Max | 0.00 | 2.44 | 0.00 | -0.00002 | 0.00231 | 0.00073 |
| 10 | C15 | Min | 0.00 | -2.44 | 0.00 | -0.00010 | -0.00109 | -0.00073 |
| 11 | C15 | Max | 0.00 | 2.44 | 0.00 | 0.00009 | 0.00209 | 0.00079 |
| 11 | C15 | Min | 0.00 | -2.44 | 0.00 | 0.00003 | -0.00088 | -0.00079 |
| 12 | C15 | Max | 0.00 | 2.44 | 0.00 | -0.00004 | 0.00193 | 0.00067 |
| 12 | C15 | Min | 0.00 | -2.44 | 0.00 | -0.00007 | -0.00076 | -0.00067 |
| 13 | C15 | Max | 0.00 | 2.44 | 0.00 | 0.00007 | 0.00209 | 0.00064 |
| 13 | C15 | Min | 0.00 | -2.44 | 0.00 | 0.00004 | -0.00093 | -0.00064 |
| 14 | C15 | Max | 0.09 | 3.76 | 0.00 | -0.00012 | -0.00059 | 0.00134 |
| 14 | C15 | Min | -0.09 | -3.76 | 0.00 | -0.00021 | -0.00088 | -0.00134 |
| 15 | C15 | Max | 0.06 | 3.77 | 0.00 | 0.00021 | -0.00059 | 0.00134 |
| 15 | C15 | Min | -0.06 | -3.76 | 0.00 | 0.00012 | -0.00088 | -0.00134 |
| 16 | C15 | Max | 0.07 | 3.76 | 0.00 | -0.00013 | -0.00058 | 0.00133 |
| 16 | C15 | Min | -0.06 | -3.76 | 0.00 | -0.00019 | -0.00087 | -0.00134 |
| 17 | C15 | Max | 0.08 | 3.77 | 0.00 | 0.00019 | -0.00058 | 0.00133 |
| 17 | C15 | Min | -0.07 | -3.76 | 0.00 | 0.00013 | -0.00087 | -0.00134 |
| 21 | C15 | Max | 0.04 | 2.44 | 0.00 | -0.00002 | 0.00231 | 0.00073 |
| 21 | C15 | Min | -0.02 | -2.44 | 0.00 | -0.00010 | -0.00109 | -0.00073 |
| 22 | C15 | Max | 0.03 | 2.44 | 0.00 | 0.00009 | 0.00209 | 0.00079 |
| 22 | C15 | Min | -0.01 | -2.44 | 0.00 | 0.00003 | -0.00088 | -0.00079 |
| 23 | C15 | Max | 0.03 | 2.44 | 0.00 | -0.00004 | 0.00193 | 0.00067 |
| 23 | C15 | Min | -0.01 | -2.44 | 0.00 | -0.00007 | -0.00075 | -0.00067 |
| 24 | C15 | Max | 0.03 | 2.44 | 0.00 | 0.00007 | 0.00209 | 0.00064 |
| 24 | C15 | Min | -0.02 | -2.44 | 0.00 | 0.00004 | -0.00093 | -0.00064 |
| 25 | C15 | Max | 0.08 | 3.76 | 0.00 | -0.00012 | -0.00059 | 0.00134 |
| 25 | C15 | Min | -0.10 | -3.76 | 0.00 | -0.00021 | -0.00088 | -0.00134 |
| 26 | C15 | Max | 0.05 | 3.76 | 0.00 | 0.00021 | -0.00059 | 0.00134 |
| 26 | C15 | Min | -0.07 | -3.76 | 0.00 | 0.00012 | -0.00088 | -0.00134 |
| 27 | C15 | Max | 0.05 | 3.76 | 0.00 | -0.00013 | -0.00058 | 0.00133 |
| 27 | C15 | Min | -0.07 | -3.76 | 0.00 | -0.00019 | -0.00087 | -0.00134 |
| 28 | C15 | Max | 0.07 | 3.76 | 0.00 | 0.00019 | -0.00058 | 0.00133 |
| 28 | C15 | Min | -0.09 | -3.76 | 0.00 | 0.00013 | -0.00087 | -0.00134 |
| 100 | C15 | Max | 0.05 | 2.44 | 0.00 | 0.00000 | 0.00073 | 0.00047 |
| 100 | C15 | Min | -0.03 | -2.44 | 0.00 | -0.00001 | 0.00048 | -0.00046 |
| 101 | C15 | Max | 0.04 | 2.44 | 0.00 | 0.00000 | 0.00073 | 0.00048 |
| 101 | C15 | Min | -0.04 | -2.44 | 0.00 | -0.00001 | 0.00048 | -0.00047 |
| 102 | C15 | Max | 0.05 | 2.52 | -0.07 | 0.00004 | 0.00066 | 0.00155 |
| 102 | C15 | Min | -0.04 | -2.51 | -0.10 | -0.00004 | 0.00044 | -0.00155 |
| 103 | C15 | Max | 0.05 | 2.64 | -0.12 | 0.00008 | 0.00048 | 0.00229 |
| 103 | C15 | Min | -0.05 | -2.64 | -0.18 | -0.00008 | 0.00032 | -0.00229 |
| 104 | C15 | Max | 0.05 | 2.89 | -0.16 | 0.00013 | 0.00015 | 0.00303 |
| 104 | C15 | Min | -0.05 | -2.89 | -0.24 | -0.00013 | 0.00009 | -0.00303 |
| 105 | C15 | Max | 0.05 | 2.95 | -0.16 | 0.00014 | 0.00007 | 0.00313 |

| Case-15: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 105 | C15 | Min | -0.05 | -2.95 | -0.24 | -0.00014 | 0.00003 | -0.00314 |
| 106 | C15 | Max | 0.05 | 3.17 | -0.16 | 0.00018 | -0.00015 | 0.00324 |
| 106 | C15 | Min | -0.05 | -3.17 | -0.23 | -0.00018 | -0.00024 | -0.00324 |
| 107 | C15 | Max | 0.06 | 3.32 | -0.14 | 0.00020 | -0.00028 | 0.00310 |
| 107 | C15 | Min | -0.05 | -3.31 | -0.20 | -0.00020 | -0.00043 | -0.00310 |
| 108 | C15 | Max | 0.06 | 3.56 | -0.09 | 0.00024 | -0.00049 | 0.00249 |
| 108 | C15 | Min | -0.06 | -3.56 | -0.13 | -0.00024 | -0.00073 | -0.00249 |
| 109 | C15 | Max | 0.06 | 3.76 | 0.00 | 0.00002 | -0.00059 | 0.00135 |
| 109 | C15 | Min | -0.06 | -3.76 | 0.00 | -0.00002 | -0.00088 | -0.00135 |
| 110 | C15 | Max | 0.05 | 3.76 | 0.00 | 0.00002 | -0.00059 | 0.00134 |
| 110 | C15 | Min | -0.07 | -3.76 | 0.00 | -0.00002 | -0.00088 | -0.00134 |
| 200 | C15 | Max | 0.05 | 2.44 | 0.00 | 0.00001 | 0.00070 | 0.00044 |
| 200 | C15 | Min | -0.03 | -2.44 | 0.00 | -0.00001 | 0.00047 | -0.00043 |
| 201 | C15 | Max | 0.04 | 2.44 | 0.00 | 0.00002 | 0.00070 | 0.00044 |
| 201 | C15 | Min | -0.04 | -2.44 | 0.00 | -0.00001 | 0.00047 | -0.00044 |
| 202 | C15 | Max | 0.04 | 2.51 | -0.07 | 0.00005 | 0.00063 | 0.00149 |
| 202 | C15 | Min | -0.04 | -2.50 | -0.10 | -0.00005 | 0.00042 | -0.00148 |
| 203 | C15 | Max | 0.04 | 2.63 | -0.12 | 0.00009 | 0.00046 | 0.00231 |
| 203 | C15 | Min | -0.04 | -2.62 | -0.18 | -0.00009 | 0.00031 | -0.00230 |
| 204 | C15 | Max | 0.05 | 2.88 | -0.15 | 0.00014 | 0.00015 | 0.00302 |
| 204 | C15 | Min | -0.04 | -2.87 | -0.23 | -0.00014 | 0.00009 | -0.00302 |
| 205 | C15 | Max | 0.05 | 2.94 | -0.16 | 0.00015 | 0.00007 | 0.00311 |
| 205 | C15 | Min | -0.04 | -2.93 | -0.23 | -0.00015 | 0.00004 | -0.00311 |
| 206 | C15 | Max | 0.05 | 3.17 | -0.15 | 0.00018 | -0.00014 | 0.00316 |
| 206 | C15 | Min | -0.05 | -3.16 | -0.23 | -0.00018 | -0.00022 | -0.00316 |
| 207 | C15 | Max | 0.05 | 3.32 | -0.13 | 0.00020 | -0.00027 | 0.00302 |
| 207 | C15 | Min | -0.05 | -3.31 | -0.20 | -0.00020 | -0.00041 | -0.00302 |
| 208 | C15 | Max | 0.05 | 3.56 | -0.08 | 0.00024 | -0.00047 | 0.00243 |
| 208 | C15 | Min | -0.05 | -3.56 | -0.12 | -0.00024 | -0.00071 | -0.00243 |
| 209 | C15 | Max | 0.05 | 3.76 | 0.00 | 0.00002 | -0.00058 | 0.00134 |
| 209 | C15 | Min | -0.05 | -3.76 | 0.00 | -0.00001 | -0.00087 | -0.00135 |
| 210 | C15 | Max | 0.04 | 3.76 | 0.00 | 0.00002 | -0.00058 | 0.00133 |
| 210 | C15 | Min | -0.06 | -3.76 | 0.00 | -0.00001 | -0.00087 | -0.00134 |
| 301 | C15 | Max | 11.46 | 3.57 | -0.09 | 0.00001 | -0.00054 | 0.00197 |
| 301 | C15 | Min | -11.56 | -3.57 | -0.13 | -0.00005 | -0.00081 | -0.00197 |
| 302 | C15 | Max | 11.54 | 3.57 | -0.08 | 0.00007 | -0.00054 | 0.00197 |
| 302 | C15 | Min | -11.64 | -3.57 | -0.12 | 0.00001 | -0.00081 | -0.00197 |
| 303 | C15 | Max | 11.46 | 3.76 | 0.00 | -0.00001 | -0.00057 | 0.00197 |
| 303 | C15 | Min | -11.56 | -3.76 | 0.00 | -0.00003 | -0.00085 | -0.00197 |
| 304 | C15 | Max | 11.54 | 3.76 | 0.00 | 0.00003 | -0.00057 | 0.00196 |
| 304 | C15 | Min | -11.64 | -3.76 | 0.00 | 0.00001 | -0.00084 | -0.00196 |
| 401 | C15 | Max | 11.47 | 3.57 | -0.09 | 0.00001 | -0.00054 | 0.00197 |
| 401 | C15 | Min | -11.54 | -3.57 | -0.13 | -0.00005 | -0.00081 | -0.00197 |
| 402 | C15 | Max | 11.55 | 3.57 | -0.08 | 0.00007 | -0.00054 | 0.00197 |
| 402 | C15 | Min | -11.62 | -3.56 | -0.12 | 0.00001 | -0.00081 | -0.00197 |
| 500 | C15 | Max | 13.26 | 6.20 | -0.05 | 0.00000 | 0.00000 | 0.00000 |
| 500 | C15 | Min | -13.36 | -6.19 | -0.07 | 0.00000 | 0.00000 | 0.00000 |
| 501 | C15 | Max | 11.50 | 3.66 | -0.05 | 0.00001 | -0.00056 | 0.00197 |

| Case-15: Joint Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | R1 | R2 | R3 |
| Text | Case | Type | in | in | in | Radians | Radians | Radians |
| 501 | C15 | Min | -11.59 | -3.66 | -0.07 | 0.00000 | -0.00083 | -0.00197 |
| 600 | C15 | Max | 16.15 | 5.75 | -0.11 | 0.00000 | 0.00000 | 0.00000 |
| 600 | C15 | Min | -16.25 | -5.74 | -0.17 | 0.00000 | 0.00000 | 0.00000 |
| 601 | C15 | Max | 11.50 | 3.59 | -0.08 | 0.00003 | -0.00055 | 0.00197 |
| 601 | C15 | Min | -11.59 | -3.59 | -0.11 | -0.00002 | -0.00081 | -0.00197 |
| 701 | C15 | Max | 0.02 | 3.57 | -0.09 | 0.00024 | -0.00049 | 0.00249 |
| 701 | C15 | Min | -0.09 | -3.57 | -0.13 | -0.00024 | -0.00073 | -0.00249 |
| 702 | C15 | Max | 0.02 | 3.57 | -0.08 | 0.00024 | -0.00047 | 0.00243 |
| 702 | C15 | Min | -0.08 | -3.56 | -0.12 | -0.00024 | -0.00071 | -0.00243 |
| 703 | C15 | Max | 0.02 | 3.76 | 0.00 | 0.00002 | -0.00059 | 0.00135 |
| 703 | C15 | Min | -0.10 | -3.76 | 0.00 | -0.00002 | -0.00088 | -0.00135 |
| 704 | C15 | Max | 0.01 | 3.77 | 0.00 | 0.00002 | -0.00058 | 0.00134 |
| 704 | C15 | Min | -0.09 | -3.76 | 0.00 | -0.00002 | -0.00087 | -0.00135 |
| 801 | C15 | Max | 0.07 | 2.44 | 0.00 | 0.00000 | 0.00073 | 0.00046 |
| 801 | C15 | Min | -0.01 | -2.44 | 0.00 | -0.00001 | 0.00048 | -0.00046 |
| 802 | C15 | Max | 0.07 | 2.44 | -0.01 | 0.00000 | 0.00071 | 0.00015 |
| 802 | C15 | Min | -0.01 | -2.44 | -0.01 | 0.00000 | 0.00048 | -0.00014 |
| 803 | C15 | Max | 0.07 | 2.44 | 0.00 | 0.00002 | 0.00070 | 0.00043 |
| 803 | C15 | Min | -0.01 | -2.44 | 0.00 | -0.00001 | 0.00047 | -0.00042 |
| 804 | C15 | Max | 0.02 | 3.76 | 0.00 | 0.00002 | -0.00059 | 0.00132 |
| 804 | C15 | Min | -0.09 | -3.76 | 0.00 | -0.00002 | -0.00088 | -0.00132 |
| 805 | C15 | Max | 0.02 | 3.76 | -0.01 | 0.00001 | -0.00059 | 0.00043 |
| 805 | C15 | Min | -0.09 | -3.76 | -0.02 | -0.00001 | -0.00087 | -0.00044 |
| 806 | C15 | Max | 0.02 | 3.77 | 0.00 | 0.00002 | -0.00058 | 0.00131 |
| 806 | C15 | Min | -0.08 | -3.76 | 0.00 | -0.00001 | -0.00087 | -0.00132 |
| | **C15** | **MAX:** | **16.25** | **6.20** | **0.24** | **0.00024** | **0.00231** | **0.00324** |

# CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT F
## JOINT ABSOLUTE ACCELERATIONS

### Tabularized Selected Output

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**Total Pages = 46**

**Summary of Maximum Accelerations for each Case:**

| Output Case | Step Type | U1 in/sec2 | U2 in/sec2 | U3 in/sec2 | U1 g | U2 g | U3 g |
|---|---|---|---|---|---|---|---|
| C01 | MAX: | 631.3 | 326.3 | 349.4 | 1.63 | 0.84 | 0.90 |
| C02 | MAX: | 659.9 | 386.7 | 235.9 | 1.71 | 1.00 | 0.61 |
| C03 | MAX: | 625.4 | 342.9 | 153.1 | 1.62 | 0.89 | 0.40 |
| C04 | MAX: | 636.3 | 346.9 | 171.5 | 1.65 | 0.90 | 0.44 |
| C05 | MAX: | 637.4 | 364.9 | 410.1 | 1.65 | 0.94 | 1.06 |
| C06 | MAX: | 623.0 | 332.0 | 158.0 | 1.61 | 0.86 | 0.41 |
| C07 | MAX: | 636.5 | 351.8 | 332.7 | 1.65 | 0.91 | 0.86 |
| C08 | MAX: | 638.7 | 397.3 | 427.1 | 1.65 | 1.03 | 1.11 |
| C09 | MAX: | 627.9 | 333.0 | 211.8 | 1.63 | 0.86 | 0.55 |
| C10 | MAX: | 640.1 | 335.6 | 150.8 | 1.66 | 0.87 | 0.39 |
| C11 | MAX: | 669.9 | 377.5 | 330.4 | 1.73 | 0.98 | 0.86 |
| C12 | MAX: | 623.2 | 334.3 | 160.5 | 1.61 | 0.87 | 0.42 |
| C13 | MAX: | 645.0 | 349.5 | 301.9 | 1.67 | 0.90 | 0.78 |
| C14 | MAX: | 626.5 | 389.5 | 468.6 | 1.62 | 1.01 | 1.21 |
| C15 | MAX: | 629.5 | 346.8 | 148.6 | 1.63 | 0.90 | 0.38 |
| | | | | MAX: | 1.73 | 1.03 | 1.21 |

**Case-01**

| CASE-01: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C01 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C01 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C01 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C01 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C01 | Max | 522.6 | 307.6 | 48.6 | 1.35 | 0.80 | 0.13 |
| 10 | C01 | Min | -522.6 | -307.6 | -48.6 | -1.35 | -0.80 | -0.13 |
| 11 | C01 | Max | 522.6 | 295.9 | 48.6 | 1.35 | 0.77 | 0.13 |
| 11 | C01 | Min | -522.6 | -295.9 | -48.6 | -1.35 | -0.77 | -0.13 |
| 12 | C01 | Max | 522.6 | 306.4 | 48.6 | 1.35 | 0.79 | 0.13 |
| 12 | C01 | Min | -522.6 | -306.4 | -48.6 | -1.35 | -0.79 | -0.13 |
| 13 | C01 | Max | 522.6 | 305.9 | 48.6 | 1.35 | 0.79 | 0.13 |
| 13 | C01 | Min | -522.6 | -305.9 | -48.6 | -1.35 | -0.79 | -0.13 |
| 14 | C01 | Max | 606.3 | 326.3 | 48.6 | 1.57 | 0.84 | 0.13 |
| 14 | C01 | Min | -606.3 | -326.3 | -48.6 | -1.57 | -0.84 | -0.13 |
| 15 | C01 | Max | 579.4 | 302.1 | 48.6 | 1.50 | 0.78 | 0.13 |
| 15 | C01 | Min | -579.4 | -302.1 | -48.6 | -1.50 | -0.78 | -0.13 |
| 16 | C01 | Max | 592.5 | 295.7 | 48.6 | 1.53 | 0.77 | 0.13 |
| 16 | C01 | Min | -592.5 | -295.7 | -48.6 | -1.53 | -0.77 | -0.13 |
| 17 | C01 | Max | 592.1 | 294.4 | 48.6 | 1.53 | 0.76 | 0.13 |
| 17 | C01 | Min | -592.1 | -294.4 | -48.6 | -1.53 | -0.76 | -0.13 |
| 21 | C01 | Max | 553.7 | 301.3 | 48.6 | 1.43 | 0.78 | 0.13 |
| 21 | C01 | Min | -553.7 | -301.3 | -48.6 | -1.43 | -0.78 | -0.13 |
| 22 | C01 | Max | 565.3 | 297.7 | 48.5 | 1.46 | 0.77 | 0.13 |
| 22 | C01 | Min | -565.3 | -297.7 | -48.5 | -1.46 | -0.77 | -0.13 |
| 23 | C01 | Max | 549.6 | 307.8 | 48.5 | 1.42 | 0.80 | 0.13 |
| 23 | C01 | Min | -549.6 | -307.8 | -48.5 | -1.42 | -0.80 | -0.13 |
| 24 | C01 | Max | 552.3 | 307.8 | 48.5 | 1.43 | 0.80 | 0.13 |
| 24 | C01 | Min | -552.3 | -307.8 | -48.5 | -1.43 | -0.80 | -0.13 |
| 25 | C01 | Max | 607.0 | 311.8 | 48.6 | 1.57 | 0.81 | 0.13 |
| 25 | C01 | Min | -607.0 | -311.8 | -48.6 | -1.57 | -0.81 | -0.13 |
| 26 | C01 | Max | 579.4 | 305.7 | 48.5 | 1.50 | 0.79 | 0.13 |
| 26 | C01 | Min | -579.4 | -305.7 | -48.5 | -1.50 | -0.79 | -0.13 |
| 27 | C01 | Max | 594.0 | 294.8 | 48.5 | 1.54 | 0.76 | 0.13 |
| 27 | C01 | Min | -594.0 | -294.8 | -48.5 | -1.54 | -0.76 | -0.13 |
| 28 | C01 | Max | 593.6 | 294.8 | 48.6 | 1.54 | 0.76 | 0.13 |
| 28 | C01 | Min | -593.6 | -294.8 | -48.6 | -1.54 | -0.76 | -0.13 |
| 100 | C01 | Max | 581.5 | 297.9 | 58.5 | 1.51 | 0.77 | 0.15 |
| 100 | C01 | Min | -581.5 | -297.9 | -58.5 | -1.51 | -0.77 | -0.15 |
| 101 | C01 | Max | 581.7 | 298.2 | 58.5 | 1.51 | 0.77 | 0.15 |
| 101 | C01 | Min | -581.7 | -298.2 | -58.5 | -1.51 | -0.77 | -0.15 |
| 102 | C01 | Max | 587.2 | 235.7 | 118.2 | 1.52 | 0.61 | 0.31 |
| 102 | C01 | Min | -587.2 | -235.7 | -118.2 | -1.52 | -0.61 | -0.31 |
| 103 | C01 | Max | 592.6 | 219.1 | 151.0 | 1.53 | 0.57 | 0.39 |
| 103 | C01 | Min | -592.6 | -219.1 | -151.0 | -1.53 | -0.57 | -0.39 |

| CASE-01: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 104 | C01 | Max | 600.9 | 203.0 | 180.8 | 1.56 | 0.53 | 0.47 |
| 104 | C01 | Min | -600.9 | -203.0 | -180.8 | -1.56 | -0.53 | -0.47 |
| 105 | C01 | Max | 598.1 | 194.2 | 181.9 | 1.55 | 0.50 | 0.47 |
| 105 | C01 | Min | -598.1 | -194.2 | -181.9 | -1.55 | -0.50 | -0.47 |
| 106 | C01 | Max | 590.7 | 197.4 | 174.6 | 1.53 | 0.51 | 0.45 |
| 106 | C01 | Min | -590.7 | -197.4 | -174.6 | -1.53 | -0.51 | -0.45 |
| 107 | C01 | Max | 588.1 | 274.0 | 154.4 | 1.52 | 0.71 | 0.40 |
| 107 | C01 | Min | -588.1 | -274.0 | -154.4 | -1.52 | -0.71 | -0.40 |
| 108 | C01 | Max | 586.0 | 278.4 | 108.9 | 1.52 | 0.72 | 0.28 |
| 108 | C01 | Min | -586.0 | -278.4 | -108.9 | -1.52 | -0.72 | -0.28 |
| 109 | C01 | Max | 585.0 | 306.3 | 56.2 | 1.51 | 0.79 | 0.15 |
| 109 | C01 | Min | -585.0 | -306.3 | -56.2 | -1.51 | -0.79 | -0.15 |
| 110 | C01 | Max | 584.7 | 305.9 | 56.2 | 1.51 | 0.79 | 0.15 |
| 110 | C01 | Min | -584.7 | -305.9 | -56.2 | -1.51 | -0.79 | -0.15 |
| 200 | C01 | Max | 571.3 | 307.3 | 53.3 | 1.48 | 0.80 | 0.14 |
| 200 | C01 | Min | -571.3 | -307.3 | -53.3 | -1.48 | -0.80 | -0.14 |
| 201 | C01 | Max | 571.4 | 310.4 | 53.3 | 1.48 | 0.80 | 0.14 |
| 201 | C01 | Min | -571.4 | -310.4 | -53.3 | -1.48 | -0.80 | -0.14 |
| 202 | C01 | Max | 575.7 | 284.8 | 142.7 | 1.49 | 0.74 | 0.37 |
| 202 | C01 | Min | -575.7 | -284.8 | -142.7 | -1.49 | -0.74 | -0.37 |
| 203 | C01 | Max | 581.5 | 217.9 | 186.6 | 1.51 | 0.56 | 0.48 |
| 203 | C01 | Min | -581.5 | -217.9 | -186.6 | -1.51 | -0.56 | -0.48 |
| 204 | C01 | Max | 598.4 | 184.0 | 183.1 | 1.55 | 0.48 | 0.47 |
| 204 | C01 | Min | -598.4 | -184.0 | -183.1 | -1.55 | -0.48 | -0.47 |
| 205 | C01 | Max | 594.0 | 172.6 | 182.8 | 1.54 | 0.45 | 0.47 |
| 205 | C01 | Min | -594.0 | -172.6 | -182.8 | -1.54 | -0.45 | -0.47 |
| 206 | C01 | Max | 584.2 | 166.5 | 173.9 | 1.51 | 0.43 | 0.45 |
| 206 | C01 | Min | -584.2 | -166.5 | -173.9 | -1.51 | -0.43 | -0.45 |
| 207 | C01 | Max | 581.7 | 234.4 | 157.7 | 1.51 | 0.61 | 0.41 |
| 207 | C01 | Min | -581.7 | -234.4 | -157.7 | -1.51 | -0.61 | -0.41 |
| 208 | C01 | Max | 584.5 | 321.2 | 117.0 | 1.51 | 0.83 | 0.30 |
| 208 | C01 | Min | -584.5 | -321.2 | -117.0 | -1.51 | -0.83 | -0.30 |
| 209 | C01 | Max | 586.0 | 294.9 | 52.0 | 1.52 | 0.76 | 0.13 |
| 209 | C01 | Min | -586.0 | -294.9 | -52.0 | -1.52 | -0.76 | -0.13 |
| 210 | C01 | Max | 587.0 | 294.8 | 52.0 | 1.52 | 0.76 | 0.13 |
| 210 | C01 | Min | -587.0 | -294.8 | -52.0 | -1.52 | -0.76 | -0.13 |
| 301 | C01 | Max | 366.4 | 249.9 | 180.9 | 0.95 | 0.65 | 0.47 |
| 301 | C01 | Min | -366.4 | -249.9 | -180.9 | -0.95 | -0.65 | -0.47 |
| 302 | C01 | Max | 358.8 | 253.3 | 183.1 | 0.93 | 0.66 | 0.47 |
| 302 | C01 | Min | -358.8 | -253.3 | -183.1 | -0.93 | -0.66 | -0.47 |
| 303 | C01 | Max | 317.6 | 261.0 | 174.7 | 0.82 | 0.68 | 0.45 |
| 303 | C01 | Min | -317.6 | -261.0 | -174.7 | -0.82 | -0.68 | -0.45 |
| 304 | C01 | Max | 323.2 | 261.3 | 173.8 | 0.84 | 0.68 | 0.45 |
| 304 | C01 | Min | -323.2 | -261.3 | -173.8 | -0.84 | -0.68 | -0.45 |
| 401 | C01 | Max | 387.3 | 245.8 | 180.9 | 1.00 | 0.64 | 0.47 |
| 401 | C01 | Min | -387.3 | -245.8 | -180.9 | -1.00 | -0.64 | -0.47 |
| 402 | C01 | Max | 366.2 | 251.1 | 183.1 | 0.95 | 0.65 | 0.47 |
| 402 | C01 | Min | -366.2 | -251.1 | -183.1 | -0.95 | -0.65 | -0.47 |

| CASE-01: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 500 | C01 | Max | 12.5 | 10.7 | 163.5 | 0.03 | 0.03 | 0.42 |
| 500 | C01 | Min | -12.5 | -10.7 | -163.5 | -0.03 | -0.03 | -0.42 |
| 501 | C01 | Max | 65.7 | 155.0 | 155.4 | 0.17 | 0.40 | 0.40 |
| 501 | C01 | Min | -65.7 | -155.0 | -155.4 | -0.17 | -0.40 | -0.40 |
| 600 | C01 | Max | 14.8 | 12.0 | 160.4 | 0.04 | 0.03 | 0.42 |
| 600 | C01 | Min | -14.8 | -12.0 | -160.4 | -0.04 | -0.03 | -0.42 |
| 601 | C01 | Max | 65.7 | 210.3 | 159.2 | 0.17 | 0.54 | 0.41 |
| 601 | C01 | Min | -65.7 | -210.3 | -159.2 | -0.17 | -0.54 | -0.41 |
| 701 | C01 | Max | 619.9 | 245.7 | 180.9 | 1.61 | 0.64 | 0.47 |
| 701 | C01 | Min | -619.9 | -245.7 | -180.9 | -1.61 | -0.64 | -0.47 |
| 702 | C01 | Max | 631.3 | 250.9 | 183.1 | 1.63 | 0.65 | 0.47 |
| 702 | C01 | Min | -631.3 | -250.9 | -183.1 | -1.63 | -0.65 | -0.47 |
| 703 | C01 | Max | 594.7 | 252.2 | 174.7 | 1.54 | 0.65 | 0.45 |
| 703 | C01 | Min | -594.7 | -252.2 | -174.7 | -1.54 | -0.65 | -0.45 |
| 704 | C01 | Max | 589.8 | 250.7 | 173.8 | 1.53 | 0.65 | 0.45 |
| 704 | C01 | Min | -589.8 | -250.7 | -173.8 | -1.53 | -0.65 | -0.45 |
| 801 | C01 | Max | 581.1 | 297.2 | 58.5 | 1.50 | 0.77 | 0.15 |
| 801 | C01 | Min | -581.1 | -297.2 | -58.5 | -1.50 | -0.77 | -0.15 |
| 802 | C01 | Max | 588.5 | 288.7 | 342.8 | 1.52 | 0.75 | 0.89 |
| 802 | C01 | Min | -588.5 | -288.7 | -342.8 | -1.52 | -0.75 | -0.89 |
| 803 | C01 | Max | 574.9 | 300.6 | 53.3 | 1.49 | 0.78 | 0.14 |
| 803 | C01 | Min | -574.9 | -300.6 | -53.3 | -1.49 | -0.78 | -0.14 |
| 804 | C01 | Max | 584.6 | 304.9 | 56.2 | 1.51 | 0.79 | 0.15 |
| 804 | C01 | Min | -584.6 | -304.9 | -56.2 | -1.51 | -0.79 | -0.15 |
| 805 | C01 | Max | 584.9 | 299.1 | 349.4 | 1.51 | 0.77 | 0.90 |
| 805 | C01 | Min | -584.9 | -299.1 | -349.4 | -1.51 | -0.77 | -0.90 |
| 806 | C01 | Max | 590.0 | 295.9 | 52.0 | 1.53 | 0.77 | 0.13 |
| 806 | C01 | Min | -590.0 | -295.9 | -52.0 | -1.53 | -0.77 | -0.13 |
| | **C01** | **MAX:** | **631.3** | **326.3** | **349.4** | **1.63** | **0.84** | **0.90** |

**Case-02**

| CASE-02: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C02 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C02 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C02 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C02 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C02 | Max | 522.6 | 339.3 | 48.5 | 1.35 | 0.88 | 0.13 |
| 10 | C02 | Min | -522.6 | -339.3 | -48.5 | -1.35 | -0.88 | -0.13 |
| 11 | C02 | Max | 522.6 | 319.3 | 48.6 | 1.35 | 0.83 | 0.13 |
| 11 | C02 | Min | -522.6 | -319.3 | -48.6 | -1.35 | -0.83 | -0.13 |
| 12 | C02 | Max | 522.6 | 288.0 | 48.6 | 1.35 | 0.75 | 0.13 |
| 12 | C02 | Min | -522.6 | -288.0 | -48.6 | -1.35 | -0.75 | -0.13 |
| 13 | C02 | Max | 522.6 | 290.3 | 48.6 | 1.35 | 0.75 | 0.13 |
| 13 | C02 | Min | -522.6 | -290.3 | -48.6 | -1.35 | -0.75 | -0.13 |
| 14 | C02 | Max | 613.6 | 386.7 | 48.6 | 1.59 | 1.00 | 0.13 |
| 14 | C02 | Min | -613.6 | -386.7 | -48.6 | -1.59 | -1.00 | -0.13 |
| 15 | C02 | Max | 659.4 | 351.8 | 48.6 | 1.71 | 0.91 | 0.13 |
| 15 | C02 | Min | -659.4 | -351.8 | -48.6 | -1.71 | -0.91 | -0.13 |
| 16 | C02 | Max | 594.4 | 330.9 | 48.6 | 1.54 | 0.86 | 0.13 |
| 16 | C02 | Min | -594.4 | -330.9 | -48.6 | -1.54 | -0.86 | -0.13 |
| 17 | C02 | Max | 617.4 | 332.3 | 48.6 | 1.60 | 0.86 | 0.13 |
| 17 | C02 | Min | -617.4 | -332.3 | -48.6 | -1.60 | -0.86 | -0.13 |
| 21 | C02 | Max | 562.2 | 329.7 | 48.5 | 1.46 | 0.85 | 0.13 |
| 21 | C02 | Min | -562.2 | -329.7 | -48.5 | -1.46 | -0.85 | -0.13 |
| 22 | C02 | Max | 555.3 | 322.6 | 48.6 | 1.44 | 0.84 | 0.13 |
| 22 | C02 | Min | -555.3 | -322.6 | -48.6 | -1.44 | -0.84 | -0.13 |
| 23 | C02 | Max | 568.9 | 287.9 | 48.6 | 1.47 | 0.75 | 0.13 |
| 23 | C02 | Min | -568.9 | -287.9 | -48.6 | -1.47 | -0.75 | -0.13 |
| 24 | C02 | Max | 561.8 | 287.9 | 48.6 | 1.45 | 0.75 | 0.13 |
| 24 | C02 | Min | -561.8 | -287.9 | -48.6 | -1.45 | -0.75 | -0.13 |
| 25 | C02 | Max | 612.1 | 368.4 | 48.6 | 1.58 | 0.95 | 0.13 |
| 25 | C02 | Min | -612.1 | -368.4 | -48.6 | -1.58 | -0.95 | -0.13 |
| 26 | C02 | Max | 659.9 | 359.7 | 48.6 | 1.71 | 0.93 | 0.13 |
| 26 | C02 | Min | -659.9 | -359.7 | -48.6 | -1.71 | -0.93 | -0.13 |
| 27 | C02 | Max | 595.4 | 331.9 | 48.6 | 1.54 | 0.86 | 0.13 |
| 27 | C02 | Min | -595.4 | -331.9 | -48.6 | -1.54 | -0.86 | -0.13 |
| 28 | C02 | Max | 613.4 | 331.9 | 48.6 | 1.59 | 0.86 | 0.13 |
| 28 | C02 | Min | -613.4 | -331.9 | -48.6 | -1.59 | -0.86 | -0.13 |
| 100 | C02 | Max | 577.7 | 322.9 | 57.3 | 1.50 | 0.84 | 0.15 |
| 100 | C02 | Min | -577.7 | -322.9 | -57.3 | -1.50 | -0.84 | -0.15 |
| 101 | C02 | Max | 575.0 | 323.4 | 57.3 | 1.49 | 0.84 | 0.15 |
| 101 | C02 | Min | -575.0 | -323.4 | -57.3 | -1.49 | -0.84 | -0.15 |
| 102 | C02 | Max | 578.9 | 260.9 | 105.4 | 1.50 | 0.68 | 0.27 |
| 102 | C02 | Min | -578.9 | -260.9 | -105.4 | -1.50 | -0.68 | -0.27 |
| 103 | C02 | Max | 583.1 | 309.7 | 145.6 | 1.51 | 0.80 | 0.38 |
| 103 | C02 | Min | -583.1 | -309.7 | -145.6 | -1.51 | -0.80 | -0.38 |
| 104 | C02 | Max | 589.4 | 293.6 | 170.8 | 1.53 | 0.76 | 0.44 |
| 104 | C02 | Min | -589.4 | -293.6 | -170.8 | -1.53 | -0.76 | -0.44 |

| CASE-02: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| 105 | C02 | Max | 591.4 | 284.8 | 171.3 | 1.53 | 0.74 | 0.44 |
| 105 | C02 | Min | -591.4 | -284.8 | -171.3 | -1.53 | -0.74 | -0.44 |
| 106 | C02 | Max | 599.5 | 213.0 | 152.8 | 1.55 | 0.55 | 0.40 |
| 106 | C02 | Min | -599.5 | -213.0 | -152.8 | -1.55 | -0.55 | -0.40 |
| 107 | C02 | Max | 605.3 | 144.2 | 128.5 | 1.57 | 0.37 | 0.33 |
| 107 | C02 | Min | -605.3 | -144.2 | -128.5 | -1.57 | -0.37 | -0.33 |
| 108 | C02 | Max | 604.2 | 220.6 | 94.0 | 1.56 | 0.57 | 0.24 |
| 108 | C02 | Min | -604.2 | -220.6 | -94.0 | -1.56 | -0.57 | -0.24 |
| 109 | C02 | Max | 607.9 | 361.7 | 57.3 | 1.57 | 0.94 | 0.15 |
| 109 | C02 | Min | -607.9 | -361.7 | -57.3 | -1.57 | -0.94 | -0.15 |
| 110 | C02 | Max | 608.2 | 360.0 | 57.3 | 1.57 | 0.93 | 0.15 |
| 110 | C02 | Min | -608.2 | -360.0 | -57.3 | -1.57 | -0.93 | -0.15 |
| 200 | C02 | Max | 587.1 | 288.1 | 51.5 | 1.52 | 0.75 | 0.13 |
| 200 | C02 | Min | -587.1 | -288.1 | -51.5 | -1.52 | -0.75 | -0.13 |
| 201 | C02 | Max | 584.9 | 286.4 | 51.5 | 1.51 | 0.74 | 0.13 |
| 201 | C02 | Min | -584.9 | -286.4 | -51.5 | -1.51 | -0.74 | -0.13 |
| 202 | C02 | Max | 586.5 | 282.9 | 117.7 | 1.52 | 0.73 | 0.30 |
| 202 | C02 | Min | -586.5 | -282.9 | -117.7 | -1.52 | -0.73 | -0.30 |
| 203 | C02 | Max | 585.1 | 293.2 | 154.2 | 1.52 | 0.76 | 0.40 |
| 203 | C02 | Min | -585.1 | -293.2 | -154.2 | -1.52 | -0.76 | -0.40 |
| 204 | C02 | Max | 581.4 | 341.8 | 160.7 | 1.51 | 0.89 | 0.42 |
| 204 | C02 | Min | -581.4 | -341.8 | -160.7 | -1.51 | -0.89 | -0.42 |
| 205 | C02 | Max | 582.6 | 334.7 | 159.3 | 1.51 | 0.87 | 0.41 |
| 205 | C02 | Min | -582.6 | -334.7 | -159.3 | -1.51 | -0.87 | -0.41 |
| 206 | C02 | Max | 592.3 | 232.8 | 145.9 | 1.53 | 0.60 | 0.38 |
| 206 | C02 | Min | -592.3 | -232.8 | -145.9 | -1.53 | -0.60 | -0.38 |
| 207 | C02 | Max | 598.7 | 168.8 | 134.1 | 1.55 | 0.44 | 0.35 |
| 207 | C02 | Min | -598.7 | -168.8 | -134.1 | -1.55 | -0.44 | -0.35 |
| 208 | C02 | Max | 593.5 | 225.2 | 104.1 | 1.54 | 0.58 | 0.27 |
| 208 | C02 | Min | -593.5 | -225.2 | -104.1 | -1.54 | -0.58 | -0.27 |
| 209 | C02 | Max | 591.7 | 334.5 | 50.8 | 1.53 | 0.87 | 0.13 |
| 209 | C02 | Min | -591.7 | -334.5 | -50.8 | -1.53 | -0.87 | -0.13 |
| 210 | C02 | Max | 590.4 | 331.7 | 50.7 | 1.53 | 0.86 | 0.13 |
| 210 | C02 | Min | -590.4 | -331.7 | -50.7 | -1.53 | -0.86 | -0.13 |
| 301 | C02 | Max | 513.5 | 290.5 | 128.5 | 1.33 | 0.75 | 0.33 |
| 301 | C02 | Min | -513.5 | -290.5 | -128.5 | -1.33 | -0.75 | -0.33 |
| 302 | C02 | Max | 541.1 | 290.5 | 134.0 | 1.40 | 0.75 | 0.35 |
| 302 | C02 | Min | -541.1 | -290.5 | -134.0 | -1.40 | -0.75 | -0.35 |
| 303 | C02 | Max | 457.8 | 317.5 | 94.1 | 1.19 | 0.82 | 0.24 |
| 303 | C02 | Min | -457.8 | -317.5 | -94.1 | -1.19 | -0.82 | -0.24 |
| 304 | C02 | Max | 472.5 | 317.5 | 104.2 | 1.22 | 0.82 | 0.27 |
| 304 | C02 | Min | -472.5 | -317.5 | -104.2 | -1.22 | -0.82 | -0.27 |
| 401 | C02 | Max | 521.3 | 294.1 | 128.5 | 1.35 | 0.76 | 0.33 |
| 401 | C02 | Min | -521.3 | -294.1 | -128.5 | -1.35 | -0.76 | -0.33 |
| 402 | C02 | Max | 549.7 | 294.0 | 134.0 | 1.42 | 0.76 | 0.35 |
| 402 | C02 | Min | -549.7 | -294.0 | -134.0 | -1.42 | -0.76 | -0.35 |
| 500 | C02 | Max | 11.7 | 9.5 | 87.6 | 0.03 | 0.02 | 0.23 |
| 500 | C02 | Min | -11.7 | -9.5 | -87.6 | -0.03 | -0.02 | -0.23 |
| 501 | C02 | Max | 63.7 | 91.9 | 81.7 | 0.16 | 0.24 | 0.21 |

| CASE-02: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| 501 | C02 | Min | -63.7 | -91.9 | -81.7 | -0.16 | -0.24 | -0.21 |
| 600 | C02 | Max | 13.8 | 9.5 | 91.2 | 0.04 | 0.02 | 0.24 |
| 600 | C02 | Min | -13.8 | -9.5 | -91.2 | -0.04 | -0.02 | -0.24 |
| 601 | C02 | Max | 63.7 | 221.4 | 88.2 | 0.16 | 0.57 | 0.23 |
| 601 | C02 | Min | -63.7 | -221.4 | -88.2 | -0.16 | -0.57 | -0.23 |
| 701 | C02 | Max | 629.7 | 293.9 | 128.5 | 1.63 | 0.76 | 0.33 |
| 701 | C02 | Min | -629.7 | -293.9 | -128.5 | -1.63 | -0.76 | -0.33 |
| 702 | C02 | Max | 615.0 | 293.8 | 134.1 | 1.59 | 0.76 | 0.35 |
| 702 | C02 | Min | -615.0 | -293.8 | -134.1 | -1.59 | -0.76 | -0.35 |
| 703 | C02 | Max | 600.1 | 310.8 | 94.0 | 1.55 | 0.80 | 0.24 |
| 703 | C02 | Min | -600.1 | -310.8 | -94.0 | -1.55 | -0.80 | -0.24 |
| 704 | C02 | Max | 591.6 | 310.4 | 104.2 | 1.53 | 0.80 | 0.27 |
| 704 | C02 | Min | -591.6 | -310.4 | -104.2 | -1.53 | -0.80 | -0.27 |
| 801 | C02 | Max | 583.5 | 321.7 | 57.3 | 1.51 | 0.83 | 0.15 |
| 801 | C02 | Min | -583.5 | -321.7 | -57.3 | -1.51 | -0.83 | -0.15 |
| 802 | C02 | Max | 598.5 | 306.5 | 235.9 | 1.55 | 0.79 | 0.61 |
| 802 | C02 | Min | -598.5 | -306.5 | -235.9 | -1.55 | -0.79 | -0.61 |
| 803 | C02 | Max | 593.7 | 292.9 | 51.5 | 1.54 | 0.76 | 0.13 |
| 803 | C02 | Min | -593.7 | -292.9 | -51.5 | -1.54 | -0.76 | -0.13 |
| 804 | C02 | Max | 609.6 | 356.3 | 57.3 | 1.58 | 0.92 | 0.15 |
| 804 | C02 | Min | -609.6 | -356.3 | -57.3 | -1.58 | -0.92 | -0.15 |
| 805 | C02 | Max | 618.8 | 337.2 | 230.6 | 1.60 | 0.87 | 0.60 |
| 805 | C02 | Min | -618.8 | -337.2 | -230.6 | -1.60 | -0.87 | -0.60 |
| 806 | C02 | Max | 588.6 | 328.3 | 50.8 | 1.52 | 0.85 | 0.13 |
| 806 | C02 | Min | -588.6 | -328.3 | -50.8 | -1.52 | -0.85 | -0.13 |
| | **C02** | **MAX:** | **659.9** | **386.7** | **235.9** | **1.71** | **1.00** | **0.61** |

**Case-03**

| CASE-03: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C03 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C03 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C03 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C03 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C03 | Max | 522.6 | 342.9 | 48.6 | 1.35 | 0.89 | 0.13 |
| 10 | C03 | Min | -522.6 | -342.9 | -48.6 | -1.35 | -0.89 | -0.13 |
| 11 | C03 | Max | 522.6 | 317.0 | 48.6 | 1.35 | 0.82 | 0.13 |
| 11 | C03 | Min | -522.6 | -317.0 | -48.6 | -1.35 | -0.82 | -0.13 |
| 12 | C03 | Max | 522.6 | 290.9 | 48.6 | 1.35 | 0.75 | 0.13 |
| 12 | C03 | Min | -522.6 | -290.9 | -48.6 | -1.35 | -0.75 | -0.13 |
| 13 | C03 | Max | 522.6 | 288.8 | 48.6 | 1.35 | 0.75 | 0.13 |
| 13 | C03 | Min | -522.6 | -288.8 | -48.6 | -1.35 | -0.75 | -0.13 |
| 14 | C03 | Max | 609.0 | 277.2 | 48.6 | 1.58 | 0.72 | 0.13 |
| 14 | C03 | Min | -609.0 | -277.2 | -48.6 | -1.58 | -0.72 | -0.13 |
| 15 | C03 | Max | 622.4 | 245.2 | 48.6 | 1.61 | 0.63 | 0.13 |
| 15 | C03 | Min | -622.4 | -245.2 | -48.6 | -1.61 | -0.63 | -0.13 |
| 16 | C03 | Max | 618.3 | 234.8 | 48.6 | 1.60 | 0.61 | 0.13 |
| 16 | C03 | Min | -618.3 | -234.8 | -48.6 | -1.60 | -0.61 | -0.13 |
| 17 | C03 | Max | 608.5 | 238.2 | 48.6 | 1.58 | 0.62 | 0.13 |
| 17 | C03 | Min | -608.5 | -238.2 | -48.6 | -1.58 | -0.62 | -0.13 |
| 21 | C03 | Max | 551.3 | 331.9 | 48.6 | 1.43 | 0.86 | 0.13 |
| 21 | C03 | Min | -551.3 | -331.9 | -48.6 | -1.43 | -0.86 | -0.13 |
| 22 | C03 | Max | 551.3 | 324.2 | 48.5 | 1.43 | 0.84 | 0.13 |
| 22 | C03 | Min | -551.3 | -324.2 | -48.5 | -1.43 | -0.84 | -0.13 |
| 23 | C03 | Max | 551.1 | 289.8 | 48.5 | 1.43 | 0.75 | 0.13 |
| 23 | C03 | Min | -551.1 | -289.8 | -48.5 | -1.43 | -0.75 | -0.13 |
| 24 | C03 | Max | 556.0 | 289.8 | 48.6 | 1.44 | 0.75 | 0.13 |
| 24 | C03 | Min | -556.0 | -289.8 | -48.6 | -1.44 | -0.75 | -0.13 |
| 25 | C03 | Max | 608.2 | 262.1 | 48.6 | 1.57 | 0.68 | 0.13 |
| 25 | C03 | Min | -608.2 | -262.1 | -48.6 | -1.57 | -0.68 | -0.13 |
| 26 | C03 | Max | 623.9 | 251.8 | 48.6 | 1.62 | 0.65 | 0.13 |
| 26 | C03 | Min | -623.9 | -251.8 | -48.6 | -1.62 | -0.65 | -0.13 |
| 27 | C03 | Max | 618.6 | 235.3 | 48.6 | 1.60 | 0.61 | 0.13 |
| 27 | C03 | Min | -618.6 | -235.3 | -48.6 | -1.60 | -0.61 | -0.13 |
| 28 | C03 | Max | 608.8 | 235.3 | 48.6 | 1.58 | 0.61 | 0.13 |
| 28 | C03 | Min | -608.8 | -235.3 | -48.6 | -1.58 | -0.61 | -0.13 |
| 100 | C03 | Max | 572.2 | 324.5 | 53.9 | 1.48 | 0.84 | 0.14 |
| 100 | C03 | Min | -572.2 | -324.5 | -53.9 | -1.48 | -0.84 | -0.14 |
| 101 | C03 | Max | 571.2 | 325.4 | 53.9 | 1.48 | 0.84 | 0.14 |
| 101 | C03 | Min | -571.2 | -325.4 | -53.9 | -1.48 | -0.84 | -0.14 |
| 102 | C03 | Max | 576.9 | 240.7 | 91.5 | 1.49 | 0.62 | 0.24 |
| 102 | C03 | Min | -576.9 | -240.7 | -91.5 | -1.49 | -0.62 | -0.24 |
| 103 | C03 | Max | 581.9 | 320.9 | 130.7 | 1.51 | 0.83 | 0.34 |
| 103 | C03 | Min | -581.9 | -320.9 | -130.7 | -1.51 | -0.83 | -0.34 |
| 104 | C03 | Max | 586.9 | 258.5 | 148.1 | 1.52 | 0.67 | 0.38 |
| 104 | C03 | Min | -586.9 | -258.5 | -148.1 | -1.52 | -0.67 | -0.38 |

| CASE-03: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C03 | Max | 588.3 | 261.7 | 144.7 | 1.52 | 0.68 | 0.37 |
| 105 | C03 | Min | -588.3 | -261.7 | -144.7 | -1.52 | -0.68 | -0.37 |
| 106 | C03 | Max | 592.9 | 328.4 | 123.7 | 1.54 | 0.85 | 0.32 |
| 106 | C03 | Min | -592.9 | -328.4 | -123.7 | -1.54 | -0.85 | -0.32 |
| 107 | C03 | Max | 596.6 | 275.8 | 114.3 | 1.54 | 0.71 | 0.30 |
| 107 | C03 | Min | -596.6 | -275.8 | -114.3 | -1.54 | -0.71 | -0.30 |
| 108 | C03 | Max | 610.2 | 118.0 | 80.8 | 1.58 | 0.31 | 0.21 |
| 108 | C03 | Min | -610.2 | -118.0 | -80.8 | -1.58 | -0.31 | -0.21 |
| 109 | C03 | Max | 606.7 | 257.6 | 61.2 | 1.57 | 0.67 | 0.16 |
| 109 | C03 | Min | -606.7 | -257.6 | -61.2 | -1.57 | -0.67 | -0.16 |
| 110 | C03 | Max | 605.6 | 252.0 | 61.2 | 1.57 | 0.65 | 0.16 |
| 110 | C03 | Min | -605.6 | -252.0 | -61.2 | -1.57 | -0.65 | -0.16 |
| 200 | C03 | Max | 572.1 | 289.8 | 49.7 | 1.48 | 0.75 | 0.13 |
| 200 | C03 | Min | -572.1 | -289.8 | -49.7 | -1.48 | -0.75 | -0.13 |
| 201 | C03 | Max | 571.5 | 289.7 | 49.7 | 1.48 | 0.75 | 0.13 |
| 201 | C03 | Min | -571.5 | -289.7 | -49.7 | -1.48 | -0.75 | -0.13 |
| 202 | C03 | Max | 573.5 | 278.8 | 93.4 | 1.49 | 0.72 | 0.24 |
| 202 | C03 | Min | -573.5 | -278.8 | -93.4 | -1.49 | -0.72 | -0.24 |
| 203 | C03 | Max | 575.5 | 286.6 | 136.3 | 1.49 | 0.74 | 0.35 |
| 203 | C03 | Min | -575.5 | -286.6 | -136.3 | -1.49 | -0.74 | -0.35 |
| 204 | C03 | Max | 580.9 | 254.1 | 152.2 | 1.50 | 0.66 | 0.39 |
| 204 | C03 | Min | -580.9 | -254.1 | -152.2 | -1.50 | -0.66 | -0.39 |
| 205 | C03 | Max | 583.1 | 259.6 | 149.0 | 1.51 | 0.67 | 0.39 |
| 205 | C03 | Min | -583.1 | -259.6 | -149.0 | -1.51 | -0.67 | -0.39 |
| 206 | C03 | Max | 593.5 | 284.7 | 127.0 | 1.54 | 0.74 | 0.33 |
| 206 | C03 | Min | -593.5 | -284.7 | -127.0 | -1.54 | -0.74 | -0.33 |
| 207 | C03 | Max | 600.4 | 235.5 | 117.3 | 1.55 | 0.61 | 0.30 |
| 207 | C03 | Min | -600.4 | -235.5 | -117.3 | -1.55 | -0.61 | -0.30 |
| 208 | C03 | Max | 612.5 | 124.7 | 86.3 | 1.59 | 0.32 | 0.22 |
| 208 | C03 | Min | -612.5 | -124.7 | -86.3 | -1.59 | -0.32 | -0.22 |
| 209 | C03 | Max | 612.1 | 235.2 | 54.6 | 1.58 | 0.61 | 0.14 |
| 209 | C03 | Min | -612.1 | -235.2 | -54.6 | -1.58 | -0.61 | -0.14 |
| 210 | C03 | Max | 612.3 | 235.4 | 54.6 | 1.59 | 0.61 | 0.14 |
| 210 | C03 | Min | -612.3 | -235.4 | -54.6 | -1.59 | -0.61 | -0.14 |
| 301 | C03 | Max | 392.2 | 234.8 | 81.0 | 1.02 | 0.61 | 0.21 |
| 301 | C03 | Min | -392.2 | -234.8 | -81.0 | -1.02 | -0.61 | -0.21 |
| 302 | C03 | Max | 407.7 | 235.2 | 86.4 | 1.06 | 0.61 | 0.22 |
| 302 | C03 | Min | -407.7 | -235.2 | -86.4 | -1.06 | -0.61 | -0.22 |
| 303 | C03 | Max | 389.2 | 239.9 | 61.1 | 1.01 | 0.62 | 0.16 |
| 303 | C03 | Min | -389.2 | -239.9 | -61.1 | -1.01 | -0.62 | -0.16 |
| 304 | C03 | Max | 385.4 | 237.2 | 54.7 | 1.00 | 0.61 | 0.14 |
| 304 | C03 | Min | -385.4 | -237.2 | -54.7 | -1.00 | -0.61 | -0.14 |
| 401 | C03 | Max | 393.6 | 235.3 | 80.9 | 1.02 | 0.61 | 0.21 |
| 401 | C03 | Min | -393.6 | -235.3 | -80.9 | -1.02 | -0.61 | -0.21 |
| 402 | C03 | Max | 412.0 | 236.0 | 86.4 | 1.07 | 0.61 | 0.22 |
| 402 | C03 | Min | -412.0 | -236.0 | -86.4 | -1.07 | -0.61 | -0.22 |
| 500 | C03 | Max | 12.1 | 9.4 | 71.6 | 0.03 | 0.02 | 0.19 |
| 500 | C03 | Min | -12.1 | -9.4 | -71.6 | -0.03 | -0.02 | -0.19 |

| CASE-03: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C03 | Max | 64.6 | 82.0 | 74.7 | 0.17 | 0.21 | 0.19 |
| 501 | C03 | Min | -64.6 | -82.0 | -74.7 | -0.17 | -0.21 | -0.19 |
| 600 | C03 | Max | 14.3 | 9.4 | 86.1 | 0.04 | 0.02 | 0.22 |
| 600 | C03 | Min | -14.3 | -9.4 | -86.1 | -0.04 | -0.02 | -0.22 |
| 601 | C03 | Max | 64.6 | 179.2 | 80.7 | 0.17 | 0.46 | 0.21 |
| 601 | C03 | Min | -64.6 | -179.2 | -80.7 | -0.17 | -0.46 | -0.21 |
| 701 | C03 | Max | 624.1 | 235.2 | 80.9 | 1.62 | 0.61 | 0.21 |
| 701 | C03 | Min | -624.1 | -235.2 | -80.9 | -1.62 | -0.61 | -0.21 |
| 702 | C03 | Max | 625.4 | 235.9 | 86.3 | 1.62 | 0.61 | 0.22 |
| 702 | C03 | Min | -625.4 | -235.9 | -86.3 | -1.62 | -0.61 | -0.22 |
| 703 | C03 | Max | 605.1 | 240.2 | 61.1 | 1.57 | 0.62 | 0.16 |
| 703 | C03 | Min | -605.1 | -240.2 | -61.1 | -1.57 | -0.62 | -0.16 |
| 704 | C03 | Max | 614.5 | 236.4 | 54.6 | 1.59 | 0.61 | 0.14 |
| 704 | C03 | Min | -614.5 | -236.4 | -54.6 | -1.59 | -0.61 | -0.14 |
| 801 | C03 | Max | 574.9 | 322.5 | 53.9 | 1.49 | 0.84 | 0.14 |
| 801 | C03 | Min | -574.9 | -322.5 | -53.9 | -1.49 | -0.84 | -0.14 |
| 802 | C03 | Max | 573.5 | 301.8 | 150.6 | 1.49 | 0.78 | 0.39 |
| 802 | C03 | Min | -573.5 | -301.8 | -150.6 | -1.49 | -0.78 | -0.39 |
| 803 | C03 | Max | 573.4 | 290.2 | 49.7 | 1.48 | 0.75 | 0.13 |
| 803 | C03 | Min | -573.4 | -290.2 | -49.7 | -1.48 | -0.75 | -0.13 |
| 804 | C03 | Max | 604.7 | 242.7 | 61.2 | 1.57 | 0.63 | 0.16 |
| 804 | C03 | Min | -604.7 | -242.7 | -61.2 | -1.57 | -0.63 | -0.16 |
| 805 | C03 | Max | 614.9 | 238.5 | 153.1 | 1.59 | 0.62 | 0.40 |
| 805 | C03 | Min | -614.9 | -238.5 | -153.1 | -1.59 | -0.62 | -0.40 |
| 806 | C03 | Max | 613.7 | 235.9 | 54.6 | 1.59 | 0.61 | 0.14 |
| 806 | C03 | Min | -613.7 | -235.9 | -54.6 | -1.59 | -0.61 | -0.14 |
| | **C03** | **MAX:** | **625.4** | **342.9** | **153.1** | **1.62** | **0.89** | **0.40** |

**Case-04**

| CASE-04: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C04 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C04 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C04 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C04 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C04 | Max | 522.6 | 326.8 | 48.6 | 1.35 | 0.85 | 0.13 |
| 10 | C04 | Min | -522.6 | -326.8 | -48.6 | -1.35 | -0.85 | -0.13 |
| 11 | C04 | Max | 522.6 | 298.4 | 48.6 | 1.35 | 0.77 | 0.13 |
| 11 | C04 | Min | -522.6 | -298.4 | -48.6 | -1.35 | -0.77 | -0.13 |
| 12 | C04 | Max | 522.6 | 312.5 | 48.6 | 1.35 | 0.81 | 0.13 |
| 12 | C04 | Min | -522.6 | -312.5 | -48.6 | -1.35 | -0.81 | -0.13 |
| 13 | C04 | Max | 522.6 | 314.1 | 48.6 | 1.35 | 0.81 | 0.13 |
| 13 | C04 | Min | -522.6 | -314.1 | -48.6 | -1.35 | -0.81 | -0.13 |
| 14 | C04 | Max | 599.3 | 346.9 | 48.6 | 1.55 | 0.90 | 0.13 |
| 14 | C04 | Min | -599.3 | -346.9 | -48.6 | -1.55 | -0.90 | -0.13 |
| 15 | C04 | Max | 592.7 | 336.5 | 48.6 | 1.53 | 0.87 | 0.13 |
| 15 | C04 | Min | -592.7 | -336.5 | -48.6 | -1.53 | -0.87 | -0.13 |
| 16 | C04 | Max | 610.3 | 318.8 | 48.6 | 1.58 | 0.83 | 0.13 |
| 16 | C04 | Min | -610.3 | -318.8 | -48.6 | -1.58 | -0.83 | -0.13 |
| 17 | C04 | Max | 616.5 | 319.6 | 48.6 | 1.60 | 0.83 | 0.13 |
| 17 | C04 | Min | -616.5 | -319.6 | -48.6 | -1.60 | -0.83 | -0.13 |
| 21 | C04 | Max | 551.7 | 311.3 | 48.6 | 1.43 | 0.81 | 0.13 |
| 21 | C04 | Min | -551.7 | -311.3 | -48.6 | -1.43 | -0.81 | -0.13 |
| 22 | C04 | Max | 566.9 | 303.7 | 48.5 | 1.47 | 0.79 | 0.13 |
| 22 | C04 | Min | -566.9 | -303.7 | -48.5 | -1.47 | -0.79 | -0.13 |
| 23 | C04 | Max | 548.3 | 314.5 | 48.5 | 1.42 | 0.81 | 0.13 |
| 23 | C04 | Min | -548.3 | -314.5 | -48.5 | -1.42 | -0.81 | -0.13 |
| 24 | C04 | Max | 555.9 | 314.5 | 48.6 | 1.44 | 0.81 | 0.13 |
| 24 | C04 | Min | -555.9 | -314.5 | -48.6 | -1.44 | -0.81 | -0.13 |
| 25 | C04 | Max | 599.0 | 342.2 | 48.6 | 1.55 | 0.89 | 0.13 |
| 25 | C04 | Min | -599.0 | -342.2 | -48.6 | -1.55 | -0.89 | -0.13 |
| 26 | C04 | Max | 592.0 | 338.6 | 48.6 | 1.53 | 0.88 | 0.13 |
| 26 | C04 | Min | -592.0 | -338.6 | -48.6 | -1.53 | -0.88 | -0.13 |
| 27 | C04 | Max | 610.5 | 319.1 | 48.6 | 1.58 | 0.83 | 0.13 |
| 27 | C04 | Min | -610.5 | -319.1 | -48.6 | -1.58 | -0.83 | -0.13 |
| 28 | C04 | Max | 617.2 | 319.1 | 48.6 | 1.60 | 0.83 | 0.13 |
| 28 | C04 | Min | -617.2 | -319.1 | -48.6 | -1.60 | -0.83 | -0.13 |
| 100 | C04 | Max | 583.4 | 304.1 | 57.4 | 1.51 | 0.79 | 0.15 |
| 100 | C04 | Min | -583.4 | -304.1 | -57.4 | -1.51 | -0.79 | -0.15 |
| 101 | C04 | Max | 583.4 | 305.0 | 57.4 | 1.51 | 0.79 | 0.15 |
| 101 | C04 | Min | -583.4 | -305.0 | -57.4 | -1.51 | -0.79 | -0.15 |
| 102 | C04 | Max | 588.7 | 241.8 | 118.2 | 1.52 | 0.63 | 0.31 |
| 102 | C04 | Min | -588.7 | -241.8 | -118.2 | -1.52 | -0.63 | -0.31 |
| 103 | C04 | Max | 593.7 | 232.2 | 158.6 | 1.54 | 0.60 | 0.41 |
| 103 | C04 | Min | -593.7 | -232.2 | -158.6 | -1.54 | -0.60 | -0.41 |
| 104 | C04 | Max | 601.6 | 184.3 | 125.8 | 1.56 | 0.48 | 0.33 |
| 104 | C04 | Min | -601.6 | -184.3 | -125.8 | -1.56 | -0.48 | -0.33 |

| CASE-04: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C04 | Max | 598.5 | 173.3 | 119.3 | 1.55 | 0.45 | 0.31 |
| 105 | C04 | Min | -598.5 | -173.3 | -119.3 | -1.55 | -0.45 | -0.31 |
| 106 | C04 | Max | 591.0 | 211.8 | 132.8 | 1.53 | 0.55 | 0.34 |
| 106 | C04 | Min | -591.0 | -211.8 | -132.8 | -1.53 | -0.55 | -0.34 |
| 107 | C04 | Max | 587.8 | 303.7 | 143.1 | 1.52 | 0.79 | 0.37 |
| 107 | C04 | Min | -587.8 | -303.7 | -143.1 | -1.52 | -0.79 | -0.37 |
| 108 | C04 | Max | 588.6 | 304.2 | 110.0 | 1.52 | 0.79 | 0.28 |
| 108 | C04 | Min | -588.6 | -304.2 | -110.0 | -1.52 | -0.79 | -0.28 |
| 109 | C04 | Max | 589.3 | 339.0 | 53.3 | 1.53 | 0.88 | 0.14 |
| 109 | C04 | Min | -589.3 | -339.0 | -53.3 | -1.53 | -0.88 | -0.14 |
| 110 | C04 | Max | 589.2 | 338.8 | 53.3 | 1.53 | 0.88 | 0.14 |
| 110 | C04 | Min | -589.2 | -338.8 | -53.3 | -1.53 | -0.88 | -0.14 |
| 200 | C04 | Max | 573.9 | 314.1 | 49.8 | 1.49 | 0.81 | 0.13 |
| 200 | C04 | Min | -573.9 | -314.1 | -49.8 | -1.49 | -0.81 | -0.13 |
| 201 | C04 | Max | 574.0 | 316.3 | 49.8 | 1.49 | 0.82 | 0.13 |
| 201 | C04 | Min | -574.0 | -316.3 | -49.8 | -1.49 | -0.82 | -0.13 |
| 202 | C04 | Max | 578.6 | 281.3 | 122.1 | 1.50 | 0.73 | 0.32 |
| 202 | C04 | Min | -578.6 | -281.3 | -122.1 | -1.50 | -0.73 | -0.32 |
| 203 | C04 | Max | 583.2 | 218.6 | 171.5 | 1.51 | 0.57 | 0.44 |
| 203 | C04 | Min | -583.2 | -218.6 | -171.5 | -1.51 | -0.57 | -0.44 |
| 204 | C04 | Max | 598.8 | 172.9 | 137.2 | 1.55 | 0.45 | 0.36 |
| 204 | C04 | Min | -598.8 | -172.9 | -137.2 | -1.55 | -0.45 | -0.36 |
| 205 | C04 | Max | 592.8 | 162.2 | 129.6 | 1.53 | 0.42 | 0.34 |
| 205 | C04 | Min | -592.8 | -162.2 | -129.6 | -1.53 | -0.42 | -0.34 |
| 206 | C04 | Max | 588.7 | 147.4 | 134.6 | 1.52 | 0.38 | 0.35 |
| 206 | C04 | Min | -588.7 | -147.4 | -134.6 | -1.52 | -0.38 | -0.35 |
| 207 | C04 | Max | 591.6 | 233.7 | 143.9 | 1.53 | 0.61 | 0.37 |
| 207 | C04 | Min | -591.6 | -233.7 | -143.9 | -1.53 | -0.61 | -0.37 |
| 208 | C04 | Max | 597.1 | 339.7 | 106.8 | 1.55 | 0.88 | 0.28 |
| 208 | C04 | Min | -597.1 | -339.7 | -106.8 | -1.55 | -0.88 | -0.28 |
| 209 | C04 | Max | 600.9 | 319.0 | 49.5 | 1.56 | 0.83 | 0.13 |
| 209 | C04 | Min | -600.9 | -319.0 | -49.5 | -1.56 | -0.83 | -0.13 |
| 210 | C04 | Max | 601.4 | 319.1 | 49.5 | 1.56 | 0.83 | 0.13 |
| 210 | C04 | Min | -601.4 | -319.1 | -49.5 | -1.56 | -0.83 | -0.13 |
| 301 | C04 | Max | 381.4 | 226.3 | 125.9 | 0.99 | 0.59 | 0.33 |
| 301 | C04 | Min | -381.4 | -226.3 | -125.9 | -0.99 | -0.59 | -0.33 |
| 302 | C04 | Max | 347.4 | 226.7 | 137.1 | 0.90 | 0.59 | 0.36 |
| 302 | C04 | Min | -347.4 | -226.7 | -137.1 | -0.90 | -0.59 | -0.36 |
| 303 | C04 | Max | 315.3 | 251.8 | 132.8 | 0.82 | 0.65 | 0.34 |
| 303 | C04 | Min | -315.3 | -251.8 | -132.8 | -0.82 | -0.65 | -0.34 |
| 304 | C04 | Max | 301.6 | 251.7 | 134.6 | 0.78 | 0.65 | 0.35 |
| 304 | C04 | Min | -301.6 | -251.7 | -134.6 | -0.78 | -0.65 | -0.35 |
| 401 | C04 | Max | 399.0 | 224.3 | 125.9 | 1.03 | 0.58 | 0.33 |
| 401 | C04 | Min | -399.0 | -224.3 | -125.9 | -1.03 | -0.58 | -0.33 |
| 402 | C04 | Max | 358.1 | 225.2 | 137.1 | 0.93 | 0.58 | 0.36 |
| 402 | C04 | Min | -358.1 | -225.2 | -137.1 | -0.93 | -0.58 | -0.36 |
| 500 | C04 | Max | 19.1 | 21.4 | 73.1 | 0.05 | 0.06 | 0.19 |
| 500 | C04 | Min | -19.1 | -21.4 | -73.1 | -0.05 | -0.06 | -0.19 |

| CASE-04: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C04 | Max | 36.9 | 156.5 | 70.3 | 0.10 | 0.41 | 0.18 |
| 501 | C04 | Min | -36.9 | -156.5 | -70.3 | -0.10 | -0.41 | -0.18 |
| 600 | C04 | Max | 24.2 | 22.5 | 80.8 | 0.06 | 0.06 | 0.21 |
| 600 | C04 | Min | -24.2 | -22.5 | -80.8 | -0.06 | -0.06 | -0.21 |
| 601 | C04 | Max | 37.0 | 188.0 | 75.0 | 0.10 | 0.49 | 0.19 |
| 601 | C04 | Min | -37.0 | -188.0 | -75.0 | -0.10 | -0.49 | -0.19 |
| 701 | C04 | Max | 627.4 | 224.2 | 125.9 | 1.62 | 0.58 | 0.33 |
| 701 | C04 | Min | -627.4 | -224.2 | -125.9 | -1.62 | -0.58 | -0.33 |
| 702 | C04 | Max | 636.3 | 225.0 | 137.2 | 1.65 | 0.58 | 0.36 |
| 702 | C04 | Min | -636.3 | -225.0 | -137.2 | -1.65 | -0.58 | -0.36 |
| 703 | C04 | Max | 594.1 | 248.9 | 132.8 | 1.54 | 0.64 | 0.34 |
| 703 | C04 | Min | -594.1 | -248.9 | -132.8 | -1.54 | -0.64 | -0.34 |
| 704 | C04 | Max | 591.2 | 247.4 | 134.6 | 1.53 | 0.64 | 0.35 |
| 704 | C04 | Min | -591.2 | -247.4 | -134.6 | -1.53 | -0.64 | -0.35 |
| 801 | C04 | Max | 585.1 | 301.9 | 57.4 | 1.51 | 0.78 | 0.15 |
| 801 | C04 | Min | -585.1 | -301.9 | -57.4 | -1.51 | -0.78 | -0.15 |
| 802 | C04 | Max | 586.6 | 299.4 | 155.2 | 1.52 | 0.78 | 0.40 |
| 802 | C04 | Min | -586.6 | -299.4 | -155.2 | -1.52 | -0.78 | -0.40 |
| 803 | C04 | Max | 573.9 | 309.2 | 49.8 | 1.49 | 0.80 | 0.13 |
| 803 | C04 | Min | -573.9 | -309.2 | -49.8 | -1.49 | -0.80 | -0.13 |
| 804 | C04 | Max | 589.9 | 338.3 | 53.3 | 1.53 | 0.88 | 0.14 |
| 804 | C04 | Min | -589.9 | -338.3 | -53.3 | -1.53 | -0.88 | -0.14 |
| 805 | C04 | Max | 602.8 | 328.8 | 145.4 | 1.56 | 0.85 | 0.38 |
| 805 | C04 | Min | -602.8 | -328.8 | -145.4 | -1.56 | -0.85 | -0.38 |
| 806 | C04 | Max | 602.3 | 320.4 | 49.5 | 1.56 | 0.83 | 0.13 |
| 806 | C04 | Min | -602.3 | -320.4 | -49.5 | -1.56 | -0.83 | -0.13 |
| | **C04** | **MAX:** | **636.3** | **346.9** | **171.5** | **1.65** | **0.90** | **0.44** |

**Case-05**

| CASE-05: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C05 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C05 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C05 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C05 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C05 | Max | 522.6 | 364.9 | 48.6 | 1.35 | 0.94 | 0.13 |
| 10 | C05 | Min | -522.6 | -364.9 | -48.6 | -1.35 | -0.94 | -0.13 |
| 11 | C05 | Max | 522.6 | 321.5 | 48.6 | 1.35 | 0.83 | 0.13 |
| 11 | C05 | Min | -522.6 | -321.5 | -48.6 | -1.35 | -0.83 | -0.13 |
| 12 | C05 | Max | 522.6 | 272.7 | 48.6 | 1.35 | 0.71 | 0.13 |
| 12 | C05 | Min | -522.6 | -272.7 | -48.6 | -1.35 | -0.71 | -0.13 |
| 13 | C05 | Max | 522.6 | 272.9 | 48.6 | 1.35 | 0.71 | 0.13 |
| 13 | C05 | Min | -522.6 | -272.9 | -48.6 | -1.35 | -0.71 | -0.13 |
| 14 | C05 | Max | 627.5 | 361.1 | 48.6 | 1.62 | 0.93 | 0.13 |
| 14 | C05 | Min | -627.5 | -361.1 | -48.6 | -1.62 | -0.93 | -0.13 |
| 15 | C05 | Max | 628.7 | 345.1 | 48.6 | 1.63 | 0.89 | 0.13 |
| 15 | C05 | Min | -628.7 | -345.1 | -48.6 | -1.63 | -0.89 | -0.13 |
| 16 | C05 | Max | 632.9 | 320.9 | 48.6 | 1.64 | 0.83 | 0.13 |
| 16 | C05 | Min | -632.9 | -320.9 | -48.6 | -1.64 | -0.83 | -0.13 |
| 17 | C05 | Max | 621.4 | 324.2 | 48.6 | 1.61 | 0.84 | 0.13 |
| 17 | C05 | Min | -621.4 | -324.2 | -48.6 | -1.61 | -0.84 | -0.13 |
| 21 | C05 | Max | 572.5 | 346.5 | 48.6 | 1.48 | 0.90 | 0.13 |
| 21 | C05 | Min | -572.5 | -346.5 | -48.6 | -1.48 | -0.90 | -0.13 |
| 22 | C05 | Max | 559.7 | 332.8 | 48.5 | 1.45 | 0.86 | 0.13 |
| 22 | C05 | Min | -559.7 | -332.8 | -48.5 | -1.45 | -0.86 | -0.13 |
| 23 | C05 | Max | 564.4 | 271.9 | 48.5 | 1.46 | 0.70 | 0.13 |
| 23 | C05 | Min | -564.4 | -271.9 | -48.5 | -1.46 | -0.70 | -0.13 |
| 24 | C05 | Max | 554.2 | 271.9 | 48.5 | 1.43 | 0.70 | 0.13 |
| 24 | C05 | Min | -554.2 | -271.9 | -48.5 | -1.43 | -0.70 | -0.13 |
| 25 | C05 | Max | 622.7 | 353.0 | 48.6 | 1.61 | 0.91 | 0.13 |
| 25 | C05 | Min | -622.7 | -353.0 | -48.6 | -1.61 | -0.91 | -0.13 |
| 26 | C05 | Max | 628.1 | 346.8 | 48.6 | 1.63 | 0.90 | 0.13 |
| 26 | C05 | Min | -628.1 | -346.8 | -48.6 | -1.63 | -0.90 | -0.13 |
| 27 | C05 | Max | 631.6 | 323.1 | 48.5 | 1.64 | 0.84 | 0.13 |
| 27 | C05 | Min | -631.6 | -323.1 | -48.5 | -1.64 | -0.84 | -0.13 |
| 28 | C05 | Max | 618.1 | 323.1 | 48.5 | 1.60 | 0.84 | 0.13 |
| 28 | C05 | Min | -618.1 | -323.1 | -48.5 | -1.60 | -0.84 | -0.13 |
| 100 | C05 | Max | 590.2 | 333.5 | 62.0 | 1.53 | 0.86 | 0.16 |
| 100 | C05 | Min | -590.2 | -333.5 | -62.0 | -1.53 | -0.86 | -0.16 |
| 101 | C05 | Max | 586.3 | 334.7 | 62.0 | 1.52 | 0.87 | 0.16 |
| 101 | C05 | Min | -586.3 | -334.7 | -62.0 | -1.52 | -0.87 | -0.16 |
| 102 | C05 | Max | 586.8 | 260.1 | 122.9 | 1.52 | 0.67 | 0.32 |
| 102 | C05 | Min | -586.8 | -260.1 | -122.9 | -1.52 | -0.67 | -0.32 |
| 103 | C05 | Max | 582.9 | 268.8 | 151.8 | 1.51 | 0.70 | 0.39 |
| 103 | C05 | Min | -582.9 | -268.8 | -151.8 | -1.51 | -0.70 | -0.39 |
| 104 | C05 | Max | 582.3 | 280.0 | 144.6 | 1.51 | 0.73 | 0.37 |
| 104 | C05 | Min | -582.3 | -280.0 | -144.6 | -1.51 | -0.73 | -0.37 |

| CASE-05: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C05 | Max | 584.9 | 275.1 | 141.3 | 1.51 | 0.71 | 0.37 |
| 105 | C05 | Min | -584.9 | -275.1 | -141.3 | -1.51 | -0.71 | -0.37 |
| 106 | C05 | Max | 600.3 | 200.1 | 119.0 | 1.55 | 0.52 | 0.31 |
| 106 | C05 | Min | -600.3 | -200.1 | -119.0 | -1.55 | -0.52 | -0.31 |
| 107 | C05 | Max | 612.7 | 128.5 | 103.6 | 1.59 | 0.33 | 0.27 |
| 107 | C05 | Min | -612.7 | -128.5 | -103.6 | -1.59 | -0.33 | -0.27 |
| 108 | C05 | Max | 604.7 | 232.0 | 93.7 | 1.57 | 0.60 | 0.24 |
| 108 | C05 | Min | -604.7 | -232.0 | -93.7 | -1.57 | -0.60 | -0.24 |
| 109 | C05 | Max | 602.2 | 348.4 | 61.9 | 1.56 | 0.90 | 0.16 |
| 109 | C05 | Min | -602.2 | -348.4 | -61.9 | -1.56 | -0.90 | -0.16 |
| 110 | C05 | Max | 599.2 | 346.9 | 61.9 | 1.55 | 0.90 | 0.16 |
| 110 | C05 | Min | -599.2 | -346.9 | -61.9 | -1.55 | -0.90 | -0.16 |
| 200 | C05 | Max | 583.4 | 271.8 | 54.1 | 1.51 | 0.70 | 0.14 |
| 200 | C05 | Min | -583.4 | -271.8 | -54.1 | -1.51 | -0.70 | -0.14 |
| 201 | C05 | Max | 581.2 | 272.5 | 54.2 | 1.51 | 0.71 | 0.14 |
| 201 | C05 | Min | -581.2 | -272.5 | -54.2 | -1.51 | -0.71 | -0.14 |
| 202 | C05 | Max | 582.4 | 283.4 | 114.9 | 1.51 | 0.73 | 0.30 |
| 202 | C05 | Min | -582.4 | -283.4 | -114.9 | -1.51 | -0.73 | -0.30 |
| 203 | C05 | Max | 583.6 | 311.9 | 158.0 | 1.51 | 0.81 | 0.41 |
| 203 | C05 | Min | -583.6 | -311.9 | -158.0 | -1.51 | -0.81 | -0.41 |
| 204 | C05 | Max | 594.6 | 338.4 | 162.2 | 1.54 | 0.88 | 0.42 |
| 204 | C05 | Min | -594.6 | -338.4 | -162.2 | -1.54 | -0.88 | -0.42 |
| 205 | C05 | Max | 597.4 | 336.2 | 157.5 | 1.55 | 0.87 | 0.41 |
| 205 | C05 | Min | -597.4 | -336.2 | -157.5 | -1.55 | -0.87 | -0.41 |
| 206 | C05 | Max | 608.5 | 249.6 | 128.2 | 1.58 | 0.65 | 0.33 |
| 206 | C05 | Min | -608.5 | -249.6 | -128.2 | -1.58 | -0.65 | -0.33 |
| 207 | C05 | Max | 617.6 | 177.0 | 117.5 | 1.60 | 0.46 | 0.30 |
| 207 | C05 | Min | -617.6 | -177.0 | -117.5 | -1.60 | -0.46 | -0.30 |
| 208 | C05 | Max | 613.5 | 253.1 | 94.1 | 1.59 | 0.66 | 0.24 |
| 208 | C05 | Min | -613.5 | -253.1 | -94.1 | -1.59 | -0.66 | -0.24 |
| 209 | C05 | Max | 612.6 | 324.2 | 54.8 | 1.59 | 0.84 | 0.14 |
| 209 | C05 | Min | -612.6 | -324.2 | -54.8 | -1.59 | -0.84 | -0.14 |
| 210 | C05 | Max | 611.3 | 322.9 | 54.8 | 1.58 | 0.84 | 0.14 |
| 210 | C05 | Min | -611.3 | -322.9 | -54.8 | -1.58 | -0.84 | -0.14 |
| 301 | C05 | Max | 572.0 | 292.1 | 103.6 | 1.48 | 0.76 | 0.27 |
| 301 | C05 | Min | -572.0 | -292.1 | -103.6 | -1.48 | -0.76 | -0.27 |
| 302 | C05 | Max | 535.3 | 287.9 | 117.5 | 1.39 | 0.75 | 0.30 |
| 302 | C05 | Min | -535.3 | -287.9 | -117.5 | -1.39 | -0.75 | -0.30 |
| 303 | C05 | Max | 493.2 | 347.1 | 93.8 | 1.28 | 0.90 | 0.24 |
| 303 | C05 | Min | -493.2 | -347.1 | -93.8 | -1.28 | -0.90 | -0.24 |
| 304 | C05 | Max | 482.2 | 347.6 | 94.2 | 1.25 | 0.90 | 0.24 |
| 304 | C05 | Min | -482.2 | -347.6 | -94.2 | -1.25 | -0.90 | -0.24 |
| 401 | C05 | Max | 587.4 | 294.4 | 103.6 | 1.52 | 0.76 | 0.27 |
| 401 | C05 | Min | -587.4 | -294.4 | -103.6 | -1.52 | -0.76 | -0.27 |
| 402 | C05 | Max | 537.0 | 287.2 | 117.5 | 1.39 | 0.74 | 0.30 |
| 402 | C05 | Min | -537.0 | -287.2 | -117.5 | -1.39 | -0.74 | -0.30 |
| 500 | C05 | Max | 18.5 | 19.2 | 80.3 | 0.05 | 0.05 | 0.21 |
| 500 | C05 | Min | -18.5 | -19.2 | -80.3 | -0.05 | -0.05 | -0.21 |

| CASE-05: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C05 | Max | 36.9 | 92.8 | 75.7 | 0.10 | 0.24 | 0.20 |
| 501 | C05 | Min | -36.9 | -92.8 | -75.7 | -0.10 | -0.24 | -0.20 |
| 600 | C05 | Max | 24.1 | 19.5 | 78.1 | 0.06 | 0.05 | 0.20 |
| 600 | C05 | Min | -24.1 | -19.5 | -78.1 | -0.06 | -0.05 | -0.20 |
| 601 | C05 | Max | 37.0 | 212.1 | 73.3 | 0.10 | 0.55 | 0.19 |
| 601 | C05 | Min | -37.0 | -212.1 | -73.3 | -0.10 | -0.55 | -0.19 |
| 701 | C05 | Max | 637.4 | 294.2 | 103.6 | 1.65 | 0.76 | 0.27 |
| 701 | C05 | Min | -637.4 | -294.2 | -103.6 | -1.65 | -0.76 | -0.27 |
| 702 | C05 | Max | 634.0 | 287.0 | 117.5 | 1.64 | 0.74 | 0.30 |
| 702 | C05 | Min | -634.0 | -287.0 | -117.5 | -1.64 | -0.74 | -0.30 |
| 703 | C05 | Max | 598.6 | 341.3 | 93.8 | 1.55 | 0.88 | 0.24 |
| 703 | C05 | Min | -598.6 | -341.3 | -93.8 | -1.55 | -0.88 | -0.24 |
| 704 | C05 | Max | 611.9 | 341.5 | 94.2 | 1.58 | 0.88 | 0.24 |
| 704 | C05 | Min | -611.9 | -341.5 | -94.2 | -1.58 | -0.88 | -0.24 |
| 801 | C05 | Max | 598.5 | 330.6 | 62.0 | 1.55 | 0.86 | 0.16 |
| 801 | C05 | Min | -598.5 | -330.6 | -62.0 | -1.55 | -0.86 | -0.16 |
| 802 | C05 | Max | 605.1 | 294.9 | 401.8 | 1.57 | 0.76 | 1.04 |
| 802 | C05 | Min | -605.1 | -294.9 | -401.8 | -1.57 | -0.76 | -1.04 |
| 803 | C05 | Max | 588.1 | 273.2 | 54.1 | 1.52 | 0.71 | 0.14 |
| 803 | C05 | Min | -588.1 | -273.2 | -54.1 | -1.52 | -0.71 | -0.14 |
| 804 | C05 | Max | 593.5 | 343.7 | 61.9 | 1.54 | 0.89 | 0.16 |
| 804 | C05 | Min | -593.5 | -343.7 | -61.9 | -1.54 | -0.89 | -0.16 |
| 805 | C05 | Max | 604.4 | 326.5 | 410.1 | 1.57 | 0.85 | 1.06 |
| 805 | C05 | Min | -604.4 | -326.5 | -410.1 | -1.57 | -0.85 | -1.06 |
| 806 | C05 | Max | 608.7 | 320.8 | 54.8 | 1.58 | 0.83 | 0.14 |
| 806 | C05 | Min | -608.7 | -320.8 | -54.8 | -1.58 | -0.83 | -0.14 |
| | **C05** | **MAX:** | **637.4** | **364.9** | **410.1** | **1.65** | **0.94** | **1.06** |

**Case-06**

| CASE-06: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C06 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C06 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C06 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C06 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C06 | Max | 522.6 | 332.0 | 48.5 | 1.35 | 0.86 | 0.13 |
| 10 | C06 | Min | -522.6 | -332.0 | -48.5 | -1.35 | -0.86 | -0.13 |
| 11 | C06 | Max | 522.6 | 305.6 | 48.6 | 1.35 | 0.79 | 0.13 |
| 11 | C06 | Min | -522.6 | -305.6 | -48.6 | -1.35 | -0.79 | -0.13 |
| 12 | C06 | Max | 522.6 | 290.7 | 48.6 | 1.35 | 0.75 | 0.13 |
| 12 | C06 | Min | -522.6 | -290.7 | -48.6 | -1.35 | -0.75 | -0.13 |
| 13 | C06 | Max | 522.6 | 291.2 | 48.6 | 1.35 | 0.75 | 0.13 |
| 13 | C06 | Min | -522.6 | -291.2 | -48.6 | -1.35 | -0.75 | -0.13 |
| 14 | C06 | Max | 618.1 | 289.3 | 48.6 | 1.60 | 0.75 | 0.13 |
| 14 | C06 | Min | -618.1 | -289.3 | -48.6 | -1.60 | -0.75 | -0.13 |
| 15 | C06 | Max | 599.6 | 258.0 | 48.6 | 1.55 | 0.67 | 0.13 |
| 15 | C06 | Min | -599.6 | -258.0 | -48.6 | -1.55 | -0.67 | -0.13 |
| 16 | C06 | Max | 615.3 | 252.8 | 48.6 | 1.59 | 0.65 | 0.13 |
| 16 | C06 | Min | -615.3 | -252.8 | -48.6 | -1.59 | -0.65 | -0.13 |
| 17 | C06 | Max | 594.1 | 260.1 | 48.6 | 1.54 | 0.67 | 0.13 |
| 17 | C06 | Min | -594.1 | -260.1 | -48.6 | -1.54 | -0.67 | -0.13 |
| 21 | C06 | Max | 556.9 | 318.8 | 48.5 | 1.44 | 0.83 | 0.13 |
| 21 | C06 | Min | -556.9 | -318.8 | -48.5 | -1.44 | -0.83 | -0.13 |
| 22 | C06 | Max | 557.6 | 312.0 | 48.6 | 1.44 | 0.81 | 0.13 |
| 22 | C06 | Min | -557.6 | -312.0 | -48.6 | -1.44 | -0.81 | -0.13 |
| 23 | C06 | Max | 556.0 | 290.5 | 48.6 | 1.44 | 0.75 | 0.13 |
| 23 | C06 | Min | -556.0 | -290.5 | -48.6 | -1.44 | -0.75 | -0.13 |
| 24 | C06 | Max | 550.8 | 290.5 | 48.5 | 1.43 | 0.75 | 0.13 |
| 24 | C06 | Min | -550.8 | -290.5 | -48.5 | -1.43 | -0.75 | -0.13 |
| 25 | C06 | Max | 616.5 | 275.6 | 48.6 | 1.60 | 0.71 | 0.13 |
| 25 | C06 | Min | -616.5 | -275.6 | -48.6 | -1.60 | -0.71 | -0.13 |
| 26 | C06 | Max | 599.6 | 266.1 | 48.5 | 1.55 | 0.69 | 0.13 |
| 26 | C06 | Min | -599.6 | -266.1 | -48.5 | -1.55 | -0.69 | -0.13 |
| 27 | C06 | Max | 617.5 | 256.3 | 48.5 | 1.60 | 0.66 | 0.13 |
| 27 | C06 | Min | -617.5 | -256.3 | -48.5 | -1.60 | -0.66 | -0.13 |
| 28 | C06 | Max | 594.8 | 256.3 | 48.5 | 1.54 | 0.66 | 0.13 |
| 28 | C06 | Min | -594.8 | -256.3 | -48.5 | -1.54 | -0.66 | -0.13 |
| 100 | C06 | Max | 586.0 | 312.2 | 59.0 | 1.52 | 0.81 | 0.15 |
| 100 | C06 | Min | -586.0 | -312.2 | -59.0 | -1.52 | -0.81 | -0.15 |
| 101 | C06 | Max | 585.6 | 312.9 | 59.0 | 1.52 | 0.81 | 0.15 |
| 101 | C06 | Min | -585.6 | -312.9 | -59.0 | -1.52 | -0.81 | -0.15 |
| 102 | C06 | Max | 591.3 | 271.9 | 107.7 | 1.53 | 0.70 | 0.28 |
| 102 | C06 | Min | -591.3 | -271.9 | -107.7 | -1.53 | -0.70 | -0.28 |
| 103 | C06 | Max | 594.5 | 325.9 | 134.1 | 1.54 | 0.84 | 0.35 |
| 103 | C06 | Min | -594.5 | -325.9 | -134.1 | -1.54 | -0.84 | -0.35 |
| 104 | C06 | Max | 595.2 | 276.6 | 125.0 | 1.54 | 0.72 | 0.32 |
| 104 | C06 | Min | -595.2 | -276.6 | -125.0 | -1.54 | -0.72 | -0.32 |

| CASE-06: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C06 | Max | 595.4 | 284.5 | 120.8 | 1.54 | 0.74 | 0.31 |
| 105 | C06 | Min | -595.4 | -284.5 | -120.8 | -1.54 | -0.74 | -0.31 |
| 106 | C06 | Max | 597.6 | 302.9 | 108.5 | 1.55 | 0.78 | 0.28 |
| 106 | C06 | Min | -597.6 | -302.9 | -108.5 | -1.55 | -0.78 | -0.28 |
| 107 | C06 | Max | 599.7 | 272.4 | 106.9 | 1.55 | 0.71 | 0.28 |
| 107 | C06 | Min | -599.7 | -272.4 | -106.9 | -1.55 | -0.71 | -0.28 |
| 108 | C06 | Max | 608.3 | 122.9 | 84.0 | 1.58 | 0.32 | 0.22 |
| 108 | C06 | Min | -608.3 | -122.9 | -84.0 | -1.58 | -0.32 | -0.22 |
| 109 | C06 | Max | 604.4 | 271.5 | 56.4 | 1.56 | 0.70 | 0.15 |
| 109 | C06 | Min | -604.4 | -271.5 | -56.4 | -1.56 | -0.70 | -0.15 |
| 110 | C06 | Max | 604.0 | 266.3 | 56.4 | 1.56 | 0.69 | 0.15 |
| 110 | C06 | Min | -604.0 | -266.3 | -56.4 | -1.56 | -0.69 | -0.15 |
| 200 | C06 | Max | 576.6 | 290.5 | 49.9 | 1.49 | 0.75 | 0.13 |
| 200 | C06 | Min | -576.6 | -290.5 | -49.9 | -1.49 | -0.75 | -0.13 |
| 201 | C06 | Max | 578.8 | 289.8 | 49.9 | 1.50 | 0.75 | 0.13 |
| 201 | C06 | Min | -578.8 | -289.8 | -49.9 | -1.50 | -0.75 | -0.13 |
| 202 | C06 | Max | 581.0 | 252.1 | 87.8 | 1.50 | 0.65 | 0.23 |
| 202 | C06 | Min | -581.0 | -252.1 | -87.8 | -1.50 | -0.65 | -0.23 |
| 203 | C06 | Max | 580.3 | 283.3 | 117.9 | 1.50 | 0.73 | 0.31 |
| 203 | C06 | Min | -580.3 | -283.3 | -117.9 | -1.50 | -0.73 | -0.31 |
| 204 | C06 | Max | 581.5 | 269.0 | 130.4 | 1.51 | 0.70 | 0.34 |
| 204 | C06 | Min | -581.5 | -269.0 | -130.4 | -1.51 | -0.70 | -0.34 |
| 205 | C06 | Max | 581.9 | 278.0 | 128.6 | 1.51 | 0.72 | 0.33 |
| 205 | C06 | Min | -581.9 | -278.0 | -128.6 | -1.51 | -0.72 | -0.33 |
| 206 | C06 | Max | 583.7 | 271.6 | 112.8 | 1.51 | 0.70 | 0.29 |
| 206 | C06 | Min | -583.7 | -271.6 | -112.8 | -1.51 | -0.70 | -0.29 |
| 207 | C06 | Max | 590.5 | 248.3 | 110.5 | 1.53 | 0.64 | 0.29 |
| 207 | C06 | Min | -590.5 | -248.3 | -110.5 | -1.53 | -0.64 | -0.29 |
| 208 | C06 | Max | 605.1 | 117.8 | 87.1 | 1.57 | 0.31 | 0.23 |
| 208 | C06 | Min | -605.1 | -117.8 | -87.1 | -1.57 | -0.31 | -0.23 |
| 209 | C06 | Max | 604.0 | 256.1 | 56.1 | 1.56 | 0.66 | 0.15 |
| 209 | C06 | Min | -604.0 | -256.1 | -56.1 | -1.56 | -0.66 | -0.15 |
| 210 | C06 | Max | 606.0 | 256.4 | 56.0 | 1.57 | 0.66 | 0.15 |
| 210 | C06 | Min | -606.0 | -256.4 | -56.0 | -1.57 | -0.66 | -0.15 |
| 301 | C06 | Max | 491.9 | 266.2 | 84.1 | 1.27 | 0.69 | 0.22 |
| 301 | C06 | Min | -491.9 | -266.2 | -84.1 | -1.27 | -0.69 | -0.22 |
| 302 | C06 | Max | 441.0 | 264.3 | 87.2 | 1.14 | 0.68 | 0.23 |
| 302 | C06 | Min | -441.0 | -264.3 | -87.2 | -1.14 | -0.68 | -0.23 |
| 303 | C06 | Max | 437.9 | 257.3 | 56.4 | 1.13 | 0.67 | 0.15 |
| 303 | C06 | Min | -437.9 | -257.3 | -56.4 | -1.13 | -0.67 | -0.15 |
| 304 | C06 | Max | 401.6 | 258.5 | 56.2 | 1.04 | 0.67 | 0.15 |
| 304 | C06 | Min | -401.6 | -258.5 | -56.2 | -1.04 | -0.67 | -0.15 |
| 401 | C06 | Max | 505.3 | 267.1 | 84.1 | 1.31 | 0.69 | 0.22 |
| 401 | C06 | Min | -505.3 | -267.1 | -84.1 | -1.31 | -0.69 | -0.22 |
| 402 | C06 | Max | 443.5 | 261.4 | 87.2 | 1.15 | 0.68 | 0.23 |
| 402 | C06 | Min | -443.5 | -261.4 | -87.2 | -1.15 | -0.68 | -0.23 |
| 500 | C06 | Max | 19.4 | 18.7 | 86.4 | 0.05 | 0.05 | 0.22 |
| 500 | C06 | Min | -19.4 | -18.7 | -86.4 | -0.05 | -0.05 | -0.22 |

| CASE-06: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C06 | Max | 37.0 | 75.8 | 67.4 | 0.10 | 0.20 | 0.17 |
| 501 | C06 | Min | -37.0 | -75.8 | -67.4 | -0.10 | -0.20 | -0.17 |
| 600 | C06 | Max | 24.9 | 20.5 | 86.3 | 0.06 | 0.05 | 0.22 |
| 600 | C06 | Min | -24.9 | -20.5 | -86.3 | -0.06 | -0.05 | -0.22 |
| 601 | C06 | Max | 37.0 | 195.5 | 82.2 | 0.10 | 0.51 | 0.21 |
| 601 | C06 | Min | -37.0 | -195.5 | -82.2 | -0.10 | -0.51 | -0.21 |
| 701 | C06 | Max | 623.0 | 267.0 | 84.1 | 1.61 | 0.69 | 0.22 |
| 701 | C06 | Min | -623.0 | -267.0 | -84.1 | -1.61 | -0.69 | -0.22 |
| 702 | C06 | Max | 622.0 | 261.3 | 87.1 | 1.61 | 0.68 | 0.23 |
| 702 | C06 | Min | -622.0 | -261.3 | -87.1 | -1.61 | -0.68 | -0.23 |
| 703 | C06 | Max | 603.1 | 254.9 | 56.4 | 1.56 | 0.66 | 0.15 |
| 703 | C06 | Min | -603.1 | -254.9 | -56.4 | -1.56 | -0.66 | -0.15 |
| 704 | C06 | Max | 611.5 | 258.1 | 56.1 | 1.58 | 0.67 | 0.15 |
| 704 | C06 | Min | -611.5 | -258.1 | -56.1 | -1.58 | -0.67 | -0.15 |
| 801 | C06 | Max | 588.1 | 310.7 | 59.0 | 1.52 | 0.80 | 0.15 |
| 801 | C06 | Min | -588.1 | -310.7 | -59.0 | -1.52 | -0.80 | -0.15 |
| 802 | C06 | Max | 591.4 | 298.4 | 158.0 | 1.53 | 0.77 | 0.41 |
| 802 | C06 | Min | -591.4 | -298.4 | -158.0 | -1.53 | -0.77 | -0.41 |
| 803 | C06 | Max | 573.1 | 292.3 | 49.9 | 1.48 | 0.76 | 0.13 |
| 803 | C06 | Min | -573.1 | -292.3 | -49.9 | -1.48 | -0.76 | -0.13 |
| 804 | C06 | Max | 603.3 | 256.7 | 56.4 | 1.56 | 0.66 | 0.15 |
| 804 | C06 | Min | -603.3 | -256.7 | -56.4 | -1.56 | -0.66 | -0.15 |
| 805 | C06 | Max | 612.0 | 254.5 | 146.3 | 1.58 | 0.66 | 0.38 |
| 805 | C06 | Min | -612.0 | -254.5 | -146.3 | -1.58 | -0.66 | -0.38 |
| 806 | C06 | Max | 610.2 | 257.0 | 56.0 | 1.58 | 0.67 | 0.15 |
| 806 | C06 | Min | -610.2 | -257.0 | -56.0 | -1.58 | -0.67 | -0.15 |
| | **C06** | **MAX:** | **623.0** | **332.0** | **158.0** | **1.61** | **0.86** | **0.41** |

**Case-07**

| CASE-07: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C07 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C07 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C07 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C07 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C07 | Max | 522.6 | 336.2 | 48.6 | 1.35 | 0.87 | 0.13 |
| 10 | C07 | Min | -522.6 | -336.2 | -48.6 | -1.35 | -0.87 | -0.13 |
| 11 | C07 | Max | 522.6 | 312.6 | 48.6 | 1.35 | 0.81 | 0.13 |
| 11 | C07 | Min | -522.6 | -312.6 | -48.6 | -1.35 | -0.81 | -0.13 |
| 12 | C07 | Max | 522.6 | 306.3 | 48.6 | 1.35 | 0.79 | 0.13 |
| 12 | C07 | Min | -522.6 | -306.3 | -48.6 | -1.35 | -0.79 | -0.13 |
| 13 | C07 | Max | 522.6 | 309.4 | 48.6 | 1.35 | 0.80 | 0.13 |
| 13 | C07 | Min | -522.6 | -309.4 | -48.6 | -1.35 | -0.80 | -0.13 |
| 14 | C07 | Max | 604.4 | 351.8 | 48.5 | 1.56 | 0.91 | 0.13 |
| 14 | C07 | Min | -604.4 | -351.8 | -48.5 | -1.56 | -0.91 | -0.13 |
| 15 | C07 | Max | 597.2 | 336.6 | 48.6 | 1.55 | 0.87 | 0.13 |
| 15 | C07 | Min | -597.2 | -336.6 | -48.6 | -1.55 | -0.87 | -0.13 |
| 16 | C07 | Max | 630.1 | 331.9 | 48.6 | 1.63 | 0.86 | 0.13 |
| 16 | C07 | Min | -630.1 | -331.9 | -48.6 | -1.63 | -0.86 | -0.13 |
| 17 | C07 | Max | 636.5 | 331.6 | 48.6 | 1.65 | 0.86 | 0.13 |
| 17 | C07 | Min | -636.5 | -331.6 | -48.6 | -1.65 | -0.86 | -0.13 |
| 21 | C07 | Max | 557.3 | 326.0 | 48.6 | 1.44 | 0.84 | 0.13 |
| 21 | C07 | Min | -557.3 | -326.0 | -48.6 | -1.44 | -0.84 | -0.13 |
| 22 | C07 | Max | 549.4 | 317.7 | 48.6 | 1.42 | 0.82 | 0.13 |
| 22 | C07 | Min | -549.4 | -317.7 | -48.6 | -1.42 | -0.82 | -0.13 |
| 23 | C07 | Max | 559.9 | 308.8 | 48.6 | 1.45 | 0.80 | 0.13 |
| 23 | C07 | Min | -559.9 | -308.8 | -48.6 | -1.45 | -0.80 | -0.13 |
| 24 | C07 | Max | 566.2 | 308.8 | 48.5 | 1.47 | 0.80 | 0.13 |
| 24 | C07 | Min | -566.2 | -308.8 | -48.5 | -1.47 | -0.80 | -0.13 |
| 25 | C07 | Max | 602.5 | 342.8 | 48.5 | 1.56 | 0.89 | 0.13 |
| 25 | C07 | Min | -602.5 | -342.8 | -48.5 | -1.56 | -0.89 | -0.13 |
| 26 | C07 | Max | 597.4 | 338.8 | 48.6 | 1.55 | 0.88 | 0.13 |
| 26 | C07 | Min | -597.4 | -338.8 | -48.6 | -1.55 | -0.88 | -0.13 |
| 27 | C07 | Max | 629.7 | 331.7 | 48.6 | 1.63 | 0.86 | 0.13 |
| 27 | C07 | Min | -629.7 | -331.7 | -48.6 | -1.63 | -0.86 | -0.13 |
| 28 | C07 | Max | 634.3 | 331.7 | 48.5 | 1.64 | 0.86 | 0.13 |
| 28 | C07 | Min | -634.3 | -331.7 | -48.5 | -1.64 | -0.86 | -0.13 |
| 100 | C07 | Max | 575.5 | 318.0 | 60.4 | 1.49 | 0.82 | 0.16 |
| 100 | C07 | Min | -575.5 | -318.0 | -60.4 | -1.49 | -0.82 | -0.16 |
| 101 | C07 | Max | 572.9 | 318.7 | 60.4 | 1.48 | 0.83 | 0.16 |
| 101 | C07 | Min | -572.9 | -318.7 | -60.4 | -1.48 | -0.83 | -0.16 |
| 102 | C07 | Max | 577.6 | 221.3 | 117.4 | 1.50 | 0.57 | 0.30 |
| 102 | C07 | Min | -577.6 | -221.3 | -117.4 | -1.50 | -0.57 | -0.30 |
| 103 | C07 | Max | 581.1 | 223.9 | 162.7 | 1.50 | 0.58 | 0.42 |
| 103 | C07 | Min | -581.1 | -223.9 | -162.7 | -1.50 | -0.58 | -0.42 |
| 104 | C07 | Max | 584.4 | 187.6 | 164.6 | 1.51 | 0.49 | 0.43 |
| 104 | C07 | Min | -584.4 | -187.6 | -164.6 | -1.51 | -0.49 | -0.43 |

| CASE-07: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C07 | Max | 584.6 | 180.3 | 166.3 | 1.51 | 0.47 | 0.43 |
| 105 | C07 | Min | -584.6 | -180.3 | -166.3 | -1.51 | -0.47 | -0.43 |
| 106 | C07 | Max | 585.1 | 203.4 | 169.2 | 1.51 | 0.53 | 0.44 |
| 106 | C07 | Min | -585.1 | -203.4 | -169.2 | -1.51 | -0.53 | -0.44 |
| 107 | C07 | Max | 585.3 | 281.3 | 146.3 | 1.52 | 0.73 | 0.38 |
| 107 | C07 | Min | -585.3 | -281.3 | -146.3 | -1.52 | -0.73 | -0.38 |
| 108 | C07 | Max | 588.9 | 289.3 | 99.7 | 1.52 | 0.75 | 0.26 |
| 108 | C07 | Min | -588.9 | -289.3 | -99.7 | -1.52 | -0.75 | -0.26 |
| 109 | C07 | Max | 592.4 | 339.1 | 54.3 | 1.53 | 0.88 | 0.14 |
| 109 | C07 | Min | -592.4 | -339.1 | -54.3 | -1.53 | -0.88 | -0.14 |
| 110 | C07 | Max | 590.2 | 339.0 | 54.3 | 1.53 | 0.88 | 0.14 |
| 110 | C07 | Min | -590.2 | -339.0 | -54.3 | -1.53 | -0.88 | -0.14 |
| 200 | C07 | Max | 588.9 | 308.5 | 51.9 | 1.52 | 0.80 | 0.13 |
| 200 | C07 | Min | -588.9 | -308.5 | -51.9 | -1.52 | -0.80 | -0.13 |
| 201 | C07 | Max | 584.1 | 310.2 | 51.9 | 1.51 | 0.80 | 0.13 |
| 201 | C07 | Min | -584.1 | -310.2 | -51.9 | -1.51 | -0.80 | -0.13 |
| 202 | C07 | Max | 588.7 | 274.5 | 124.1 | 1.52 | 0.71 | 0.32 |
| 202 | C07 | Min | -588.7 | -274.5 | -124.1 | -1.52 | -0.71 | -0.32 |
| 203 | C07 | Max | 594.0 | 253.0 | 172.2 | 1.54 | 0.66 | 0.45 |
| 203 | C07 | Min | -594.0 | -253.0 | -172.2 | -1.54 | -0.66 | -0.45 |
| 204 | C07 | Max | 602.8 | 181.4 | 167.8 | 1.56 | 0.47 | 0.43 |
| 204 | C07 | Min | -602.8 | -181.4 | -167.8 | -1.56 | -0.47 | -0.43 |
| 205 | C07 | Max | 601.6 | 174.2 | 162.6 | 1.56 | 0.45 | 0.42 |
| 205 | C07 | Min | -601.6 | -174.2 | -162.6 | -1.56 | -0.45 | -0.42 |
| 206 | C07 | Max | 600.6 | 159.4 | 162.1 | 1.56 | 0.41 | 0.42 |
| 206 | C07 | Min | -600.6 | -159.4 | -162.1 | -1.56 | -0.41 | -0.42 |
| 207 | C07 | Max | 605.4 | 223.4 | 151.9 | 1.57 | 0.58 | 0.39 |
| 207 | C07 | Min | -605.4 | -223.4 | -151.9 | -1.57 | -0.58 | -0.39 |
| 208 | C07 | Max | 615.7 | 311.7 | 110.8 | 1.59 | 0.81 | 0.29 |
| 208 | C07 | Min | -615.7 | -311.7 | -110.8 | -1.59 | -0.81 | -0.29 |
| 209 | C07 | Max | 623.0 | 331.4 | 51.5 | 1.61 | 0.86 | 0.13 |
| 209 | C07 | Min | -623.0 | -331.4 | -51.5 | -1.61 | -0.86 | -0.13 |
| 210 | C07 | Max | 621.0 | 331.6 | 51.5 | 1.61 | 0.86 | 0.13 |
| 210 | C07 | Min | -621.0 | -331.6 | -51.5 | -1.61 | -0.86 | -0.13 |
| 301 | C07 | Max | 333.4 | 225.1 | 164.7 | 0.86 | 0.58 | 0.43 |
| 301 | C07 | Min | -333.4 | -225.1 | -164.7 | -0.86 | -0.58 | -0.43 |
| 302 | C07 | Max | 309.5 | 226.2 | 168.0 | 0.80 | 0.59 | 0.43 |
| 302 | C07 | Min | -309.5 | -226.2 | -168.0 | -0.80 | -0.59 | -0.43 |
| 303 | C07 | Max | 283.0 | 238.1 | 169.2 | 0.73 | 0.62 | 0.44 |
| 303 | C07 | Min | -283.0 | -238.1 | -169.2 | -0.73 | -0.62 | -0.44 |
| 304 | C07 | Max | 273.2 | 238.5 | 162.1 | 0.71 | 0.62 | 0.42 |
| 304 | C07 | Min | -273.2 | -238.5 | -162.1 | -0.71 | -0.62 | -0.42 |
| 401 | C07 | Max | 349.9 | 221.7 | 164.7 | 0.91 | 0.57 | 0.43 |
| 401 | C07 | Min | -349.9 | -221.7 | -164.7 | -0.91 | -0.57 | -0.43 |
| 402 | C07 | Max | 321.7 | 223.2 | 168.0 | 0.83 | 0.58 | 0.43 |
| 402 | C07 | Min | -321.7 | -223.2 | -168.0 | -0.83 | -0.58 | -0.43 |
| 500 | C07 | Max | 2.7 | 1.7 | 323.9 | 0.01 | 0.00 | 0.84 |
| 500 | C07 | Min | -2.7 | -1.7 | -323.9 | -0.01 | 0.00 | -0.84 |

| CASE-07: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C07 | Max | 39.6 | 160.2 | 137.1 | 0.10 | 0.41 | 0.36 |
| 501 | C07 | Min | -39.6 | -160.2 | -137.1 | -0.10 | -0.41 | -0.36 |
| 600 | C07 | Max | 29.1 | 23.3 | 143.9 | 0.08 | 0.06 | 0.37 |
| 600 | C07 | Min | -29.1 | -23.3 | -143.9 | -0.08 | -0.06 | -0.37 |
| 601 | C07 | Max | 39.6 | 192.5 | 144.7 | 0.10 | 0.50 | 0.37 |
| 601 | C07 | Min | -39.6 | -192.5 | -144.7 | -0.10 | -0.50 | -0.37 |
| 701 | C07 | Max | 602.6 | 221.6 | 164.6 | 1.56 | 0.57 | 0.43 |
| 701 | C07 | Min | -602.6 | -221.6 | -164.6 | -1.56 | -0.57 | -0.43 |
| 702 | C07 | Max | 617.1 | 223.1 | 167.9 | 1.60 | 0.58 | 0.43 |
| 702 | C07 | Min | -617.1 | -223.1 | -167.9 | -1.60 | -0.58 | -0.43 |
| 703 | C07 | Max | 586.2 | 232.5 | 169.2 | 1.52 | 0.60 | 0.44 |
| 703 | C07 | Min | -586.2 | -232.5 | -169.2 | -1.52 | -0.60 | -0.44 |
| 704 | C07 | Max | 601.8 | 232.8 | 162.1 | 1.56 | 0.60 | 0.42 |
| 704 | C07 | Min | -601.8 | -232.8 | -162.1 | -1.56 | -0.60 | -0.42 |
| 801 | C07 | Max | 581.2 | 316.5 | 60.4 | 1.50 | 0.82 | 0.16 |
| 801 | C07 | Min | -581.2 | -316.5 | -60.4 | -1.50 | -0.82 | -0.16 |
| 802 | C07 | Max | 586.1 | 307.1 | 332.7 | 1.52 | 0.80 | 0.86 |
| 802 | C07 | Min | -586.1 | -307.1 | -332.7 | -1.52 | -0.80 | -0.86 |
| 803 | C07 | Max | 599.3 | 305.6 | 51.9 | 1.55 | 0.79 | 0.13 |
| 803 | C07 | Min | -599.3 | -305.6 | -51.9 | -1.55 | -0.79 | -0.13 |
| 804 | C07 | Max | 587.8 | 338.5 | 54.3 | 1.52 | 0.88 | 0.14 |
| 804 | C07 | Min | -587.8 | -338.5 | -54.3 | -1.52 | -0.88 | -0.14 |
| 805 | C07 | Max | 622.7 | 332.0 | 328.0 | 1.61 | 0.86 | 0.85 |
| 805 | C07 | Min | -622.7 | -332.0 | -328.0 | -1.61 | -0.86 | -0.85 |
| 806 | C07 | Max | 618.9 | 332.0 | 51.5 | 1.60 | 0.86 | 0.13 |
| 806 | C07 | Min | -618.9 | -332.0 | -51.5 | -1.60 | -0.86 | -0.13 |
| | **C07** | **MAX:** | **636.5** | **351.8** | **332.7** | **1.65** | **0.91** | **0.86** |

**Case-08**

| CASE-08: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C08 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C08 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C08 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C08 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C08 | Max | 522.6 | 345.9 | 48.6 | 1.35 | 0.90 | 0.13 |
| 10 | C08 | Min | -522.6 | -345.9 | -48.6 | -1.35 | -0.90 | -0.13 |
| 11 | C08 | Max | 522.6 | 314.2 | 48.6 | 1.35 | 0.81 | 0.13 |
| 11 | C08 | Min | -522.6 | -314.2 | -48.6 | -1.35 | -0.81 | -0.13 |
| 12 | C08 | Max | 522.6 | 278.5 | 48.6 | 1.35 | 0.72 | 0.13 |
| 12 | C08 | Min | -522.6 | -278.5 | -48.6 | -1.35 | -0.72 | -0.13 |
| 13 | C08 | Max | 522.6 | 276.5 | 48.6 | 1.35 | 0.72 | 0.13 |
| 13 | C08 | Min | -522.6 | -276.5 | -48.6 | -1.35 | -0.72 | -0.13 |
| 14 | C08 | Max | 638.7 | 397.3 | 48.6 | 1.65 | 1.03 | 0.13 |
| 14 | C08 | Min | -638.7 | -397.3 | -48.6 | -1.65 | -1.03 | -0.13 |
| 15 | C08 | Max | 633.7 | 355.5 | 48.6 | 1.64 | 0.92 | 0.13 |
| 15 | C08 | Min | -633.7 | -355.5 | -48.6 | -1.64 | -0.92 | -0.13 |
| 16 | C08 | Max | 610.4 | 320.5 | 48.6 | 1.58 | 0.83 | 0.13 |
| 16 | C08 | Min | -610.4 | -320.5 | -48.6 | -1.58 | -0.83 | -0.13 |
| 17 | C08 | Max | 604.1 | 317.1 | 48.6 | 1.56 | 0.82 | 0.13 |
| 17 | C08 | Min | -604.1 | -317.1 | -48.6 | -1.56 | -0.82 | -0.13 |
| 21 | C08 | Max | 560.7 | 332.2 | 48.6 | 1.45 | 0.86 | 0.13 |
| 21 | C08 | Min | -560.7 | -332.2 | -48.6 | -1.45 | -0.86 | -0.13 |
| 22 | C08 | Max | 562.8 | 322.5 | 48.6 | 1.46 | 0.84 | 0.13 |
| 22 | C08 | Min | -562.8 | -322.5 | -48.6 | -1.46 | -0.84 | -0.13 |
| 23 | C08 | Max | 566.9 | 276.6 | 48.6 | 1.47 | 0.72 | 0.13 |
| 23 | C08 | Min | -566.9 | -276.6 | -48.6 | -1.47 | -0.72 | -0.13 |
| 24 | C08 | Max | 566.3 | 276.6 | 48.5 | 1.47 | 0.72 | 0.13 |
| 24 | C08 | Min | -566.3 | -276.6 | -48.5 | -1.47 | -0.72 | -0.13 |
| 25 | C08 | Max | 638.0 | 377.7 | 48.6 | 1.65 | 0.98 | 0.13 |
| 25 | C08 | Min | -638.0 | -377.7 | -48.6 | -1.65 | -0.98 | -0.13 |
| 26 | C08 | Max | 634.2 | 365.7 | 48.6 | 1.64 | 0.95 | 0.13 |
| 26 | C08 | Min | -634.2 | -365.7 | -48.6 | -1.64 | -0.95 | -0.13 |
| 27 | C08 | Max | 610.6 | 318.4 | 48.6 | 1.58 | 0.82 | 0.13 |
| 27 | C08 | Min | -610.6 | -318.4 | -48.6 | -1.58 | -0.82 | -0.13 |
| 28 | C08 | Max | 599.1 | 318.4 | 48.6 | 1.55 | 0.82 | 0.13 |
| 28 | C08 | Min | -599.1 | -318.4 | -48.6 | -1.55 | -0.82 | -0.13 |
| 100 | C08 | Max | 584.2 | 322.9 | 55.5 | 1.51 | 0.84 | 0.14 |
| 100 | C08 | Min | -584.2 | -322.9 | -55.5 | -1.51 | -0.84 | -0.14 |
| 101 | C08 | Max | 578.9 | 324.2 | 55.5 | 1.50 | 0.84 | 0.14 |
| 101 | C08 | Min | -578.9 | -324.2 | -55.5 | -1.50 | -0.84 | -0.14 |
| 102 | C08 | Max | 583.5 | 264.9 | 125.4 | 1.51 | 0.69 | 0.32 |
| 102 | C08 | Min | -583.5 | -264.9 | -125.4 | -1.51 | -0.69 | -0.32 |
| 103 | C08 | Max | 587.6 | 294.3 | 174.7 | 1.52 | 0.76 | 0.45 |
| 103 | C08 | Min | -587.6 | -294.3 | -174.7 | -1.52 | -0.76 | -0.45 |
| 104 | C08 | Max | 592.2 | 290.1 | 180.1 | 1.53 | 0.75 | 0.47 |
| 104 | C08 | Min | -592.2 | -290.1 | -180.1 | -1.53 | -0.75 | -0.47 |

| CASE-08: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C08 | Max | 594.1 | 289.6 | 175.8 | 1.54 | 0.75 | 0.46 |
| 105 | C08 | Min | -594.1 | -289.6 | -175.8 | -1.54 | -0.75 | -0.46 |
| 106 | C08 | Max | 603.7 | 205.5 | 158.0 | 1.56 | 0.53 | 0.41 |
| 106 | C08 | Min | -603.7 | -205.5 | -158.0 | -1.56 | -0.53 | -0.41 |
| 107 | C08 | Max | 608.8 | 131.8 | 141.4 | 1.58 | 0.34 | 0.37 |
| 107 | C08 | Min | -608.8 | -131.8 | -141.4 | -1.58 | -0.34 | -0.37 |
| 108 | C08 | Max | 610.7 | 224.7 | 102.7 | 1.58 | 0.58 | 0.27 |
| 108 | C08 | Min | -610.7 | -224.7 | -102.7 | -1.58 | -0.58 | -0.27 |
| 109 | C08 | Max | 614.8 | 368.3 | 58.1 | 1.59 | 0.95 | 0.15 |
| 109 | C08 | Min | -614.8 | -368.3 | -58.1 | -1.59 | -0.95 | -0.15 |
| 110 | C08 | Max | 614.9 | 366.1 | 58.1 | 1.59 | 0.95 | 0.15 |
| 110 | C08 | Min | -614.9 | -366.1 | -58.1 | -1.59 | -0.95 | -0.15 |
| 200 | C08 | Max | 591.6 | 276.5 | 52.6 | 1.53 | 0.72 | 0.14 |
| 200 | C08 | Min | -591.6 | -276.5 | -52.6 | -1.53 | -0.72 | -0.14 |
| 201 | C08 | Max | 588.1 | 276.6 | 52.6 | 1.52 | 0.72 | 0.14 |
| 201 | C08 | Min | -588.1 | -276.6 | -52.6 | -1.52 | -0.72 | -0.14 |
| 202 | C08 | Max | 590.4 | 284.1 | 134.9 | 1.53 | 0.74 | 0.35 |
| 202 | C08 | Min | -590.4 | -284.1 | -134.9 | -1.53 | -0.74 | -0.35 |
| 203 | C08 | Max | 589.9 | 325.9 | 179.1 | 1.53 | 0.84 | 0.46 |
| 203 | C08 | Min | -589.9 | -325.9 | -179.1 | -1.53 | -0.84 | -0.46 |
| 204 | C08 | Max | 587.3 | 351.4 | 177.9 | 1.52 | 0.91 | 0.46 |
| 204 | C08 | Min | -587.3 | -351.4 | -177.9 | -1.52 | -0.91 | -0.46 |
| 205 | C08 | Max | 587.2 | 336.7 | 176.3 | 1.52 | 0.87 | 0.46 |
| 205 | C08 | Min | -587.2 | -336.7 | -176.3 | -1.52 | -0.87 | -0.46 |
| 206 | C08 | Max | 589.5 | 209.7 | 163.7 | 1.53 | 0.54 | 0.42 |
| 206 | C08 | Min | -589.5 | -209.7 | -163.7 | -1.53 | -0.54 | -0.42 |
| 207 | C08 | Max | 595.8 | 127.8 | 155.1 | 1.54 | 0.33 | 0.40 |
| 207 | C08 | Min | -595.8 | -127.8 | -155.1 | -1.54 | -0.33 | -0.40 |
| 208 | C08 | Max | 586.2 | 234.1 | 119.2 | 1.52 | 0.61 | 0.31 |
| 208 | C08 | Min | -586.2 | -234.1 | -119.2 | -1.52 | -0.61 | -0.31 |
| 209 | C08 | Max | 585.2 | 318.3 | 51.5 | 1.52 | 0.82 | 0.13 |
| 209 | C08 | Min | -585.2 | -318.3 | -51.5 | -1.52 | -0.82 | -0.13 |
| 210 | C08 | Max | 583.3 | 318.4 | 51.5 | 1.51 | 0.82 | 0.13 |
| 210 | C08 | Min | -583.3 | -318.4 | -51.5 | -1.51 | -0.82 | -0.13 |
| 301 | C08 | Max | 493.9 | 267.0 | 141.4 | 1.28 | 0.69 | 0.37 |
| 301 | C08 | Min | -493.9 | -267.0 | -141.4 | -1.28 | -0.69 | -0.37 |
| 302 | C08 | Max | 519.0 | 268.3 | 155.1 | 1.34 | 0.69 | 0.40 |
| 302 | C08 | Min | -519.0 | -268.3 | -155.1 | -1.34 | -0.69 | -0.40 |
| 303 | C08 | Max | 442.3 | 327.6 | 102.7 | 1.15 | 0.85 | 0.27 |
| 303 | C08 | Min | -442.3 | -327.6 | -102.7 | -1.15 | -0.85 | -0.27 |
| 304 | C08 | Max | 461.5 | 327.8 | 119.3 | 1.19 | 0.85 | 0.31 |
| 304 | C08 | Min | -461.5 | -327.8 | -119.3 | -1.19 | -0.85 | -0.31 |
| 401 | C08 | Max | 503.9 | 275.3 | 141.4 | 1.30 | 0.71 | 0.37 |
| 401 | C08 | Min | -503.9 | -275.3 | -141.4 | -1.30 | -0.71 | -0.37 |
| 402 | C08 | Max | 528.2 | 274.9 | 155.1 | 1.37 | 0.71 | 0.40 |
| 402 | C08 | Min | -528.2 | -274.9 | -155.1 | -1.37 | -0.71 | -0.40 |
| 500 | C08 | Max | 2.7 | 1.9 | 262.3 | 0.01 | 0.00 | 0.68 |
| 500 | C08 | Min | -2.7 | -1.9 | -262.3 | -0.01 | 0.00 | -0.68 |

| CASE-08: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C08 | Max | 39.5 | 87.2 | 97.1 | 0.10 | 0.23 | 0.25 |
| 501 | C08 | Min | -39.5 | -87.2 | -97.1 | -0.10 | -0.23 | -0.25 |
| 600 | C08 | Max | 29.4 | 20.7 | 114.6 | 0.08 | 0.05 | 0.30 |
| 600 | C08 | Min | -29.4 | -20.7 | -114.6 | -0.08 | -0.05 | -0.30 |
| 601 | C08 | Max | 39.5 | 197.5 | 104.5 | 0.10 | 0.51 | 0.27 |
| 601 | C08 | Min | -39.5 | -197.5 | -104.5 | -0.10 | -0.51 | -0.27 |
| 701 | C08 | Max | 625.7 | 275.1 | 141.4 | 1.62 | 0.71 | 0.37 |
| 701 | C08 | Min | -625.7 | -275.1 | -141.4 | -1.62 | -0.71 | -0.37 |
| 702 | C08 | Max | 617.1 | 274.8 | 155.1 | 1.60 | 0.71 | 0.40 |
| 702 | C08 | Min | -617.1 | -274.8 | -155.1 | -1.60 | -0.71 | -0.40 |
| 703 | C08 | Max | 602.8 | 320.9 | 102.7 | 1.56 | 0.83 | 0.27 |
| 703 | C08 | Min | -602.8 | -320.9 | -102.7 | -1.56 | -0.83 | -0.27 |
| 704 | C08 | Max | 583.3 | 321.4 | 119.3 | 1.51 | 0.83 | 0.31 |
| 704 | C08 | Min | -583.3 | -321.4 | -119.3 | -1.51 | -0.83 | -0.31 |
| 801 | C08 | Max | 595.4 | 319.9 | 55.5 | 1.54 | 0.83 | 0.14 |
| 801 | C08 | Min | -595.4 | -319.9 | -55.5 | -1.54 | -0.83 | -0.14 |
| 802 | C08 | Max | 599.8 | 295.7 | 421.6 | 1.55 | 0.77 | 1.09 |
| 802 | C08 | Min | -599.8 | -295.7 | -421.6 | -1.55 | -0.77 | -1.09 |
| 803 | C08 | Max | 599.2 | 278.6 | 52.6 | 1.55 | 0.72 | 0.14 |
| 803 | C08 | Min | -599.2 | -278.6 | -52.6 | -1.55 | -0.72 | -0.14 |
| 804 | C08 | Max | 615.3 | 361.8 | 58.1 | 1.59 | 0.94 | 0.15 |
| 804 | C08 | Min | -615.3 | -361.8 | -58.1 | -1.59 | -0.94 | -0.15 |
| 805 | C08 | Max | 618.2 | 337.4 | 427.1 | 1.60 | 0.87 | 1.11 |
| 805 | C08 | Min | -618.2 | -337.4 | -427.1 | -1.60 | -0.87 | -1.11 |
| 806 | C08 | Max | 583.3 | 321.1 | 51.5 | 1.51 | 0.83 | 0.13 |
| 806 | C08 | Min | -583.3 | -321.1 | -51.5 | -1.51 | -0.83 | -0.13 |
| | **C08** | **MAX:** | **638.7** | **397.3** | **427.1** | **1.65** | **1.03** | **1.11** |

**Case-09**

| CASE-09: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C09 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C09 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C09 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C09 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C09 | Max | 522.6 | 325.6 | 48.6 | 1.35 | 0.84 | 0.13 |
| 10 | C09 | Min | -522.6 | -325.6 | -48.6 | -1.35 | -0.84 | -0.13 |
| 11 | C09 | Max | 522.6 | 298.0 | 48.6 | 1.35 | 0.77 | 0.13 |
| 11 | C09 | Min | -522.6 | -298.0 | -48.6 | -1.35 | -0.77 | -0.13 |
| 12 | C09 | Max | 522.6 | 276.0 | 48.6 | 1.35 | 0.71 | 0.13 |
| 12 | C09 | Min | -522.6 | -276.0 | -48.6 | -1.35 | -0.71 | -0.13 |
| 13 | C09 | Max | 522.6 | 275.7 | 48.6 | 1.35 | 0.71 | 0.13 |
| 13 | C09 | Min | -522.6 | -275.7 | -48.6 | -1.35 | -0.71 | -0.13 |
| 14 | C09 | Max | 614.7 | 292.8 | 48.5 | 1.59 | 0.76 | 0.13 |
| 14 | C09 | Min | -614.7 | -292.8 | -48.5 | -1.59 | -0.76 | -0.13 |
| 15 | C09 | Max | 613.9 | 268.6 | 48.6 | 1.59 | 0.70 | 0.13 |
| 15 | C09 | Min | -613.9 | -268.6 | -48.6 | -1.59 | -0.70 | -0.13 |
| 16 | C09 | Max | 590.4 | 265.1 | 48.6 | 1.53 | 0.69 | 0.13 |
| 16 | C09 | Min | -590.4 | -265.1 | -48.6 | -1.53 | -0.69 | -0.13 |
| 17 | C09 | Max | 592.0 | 261.9 | 48.6 | 1.53 | 0.68 | 0.13 |
| 17 | C09 | Min | -592.0 | -261.9 | -48.6 | -1.53 | -0.68 | -0.13 |
| 21 | C09 | Max | 564.8 | 312.0 | 48.6 | 1.46 | 0.81 | 0.13 |
| 21 | C09 | Min | -564.8 | -312.0 | -48.6 | -1.46 | -0.81 | -0.13 |
| 22 | C09 | Max | 557.4 | 304.5 | 48.5 | 1.44 | 0.79 | 0.13 |
| 22 | C09 | Min | -557.4 | -304.5 | -48.5 | -1.44 | -0.79 | -0.13 |
| 23 | C09 | Max | 552.4 | 275.8 | 48.5 | 1.43 | 0.71 | 0.13 |
| 23 | C09 | Min | -552.4 | -275.8 | -48.5 | -1.43 | -0.71 | -0.13 |
| 24 | C09 | Max | 546.8 | 275.8 | 48.6 | 1.42 | 0.71 | 0.13 |
| 24 | C09 | Min | -546.8 | -275.8 | -48.6 | -1.42 | -0.71 | -0.13 |
| 25 | C09 | Max | 614.5 | 282.7 | 48.5 | 1.59 | 0.73 | 0.13 |
| 25 | C09 | Min | -614.5 | -282.7 | -48.5 | -1.59 | -0.73 | -0.13 |
| 26 | C09 | Max | 613.2 | 275.7 | 48.6 | 1.59 | 0.71 | 0.13 |
| 26 | C09 | Min | -613.2 | -275.7 | -48.6 | -1.59 | -0.71 | -0.13 |
| 27 | C09 | Max | 589.7 | 263.4 | 48.6 | 1.53 | 0.68 | 0.13 |
| 27 | C09 | Min | -589.7 | -263.4 | -48.6 | -1.53 | -0.68 | -0.13 |
| 28 | C09 | Max | 591.8 | 263.4 | 48.5 | 1.53 | 0.68 | 0.13 |
| 28 | C09 | Min | -591.8 | -263.4 | -48.5 | -1.53 | -0.68 | -0.13 |
| 100 | C09 | Max | 596.2 | 304.7 | 57.5 | 1.54 | 0.79 | 0.15 |
| 100 | C09 | Min | -596.2 | -304.7 | -57.5 | -1.54 | -0.79 | -0.15 |
| 101 | C09 | Max | 596.7 | 305.4 | 57.5 | 1.55 | 0.79 | 0.15 |
| 101 | C09 | Min | -596.7 | -305.4 | -57.5 | -1.55 | -0.79 | -0.15 |
| 102 | C09 | Max | 603.0 | 235.2 | 94.9 | 1.56 | 0.61 | 0.25 |
| 102 | C09 | Min | -603.0 | -235.2 | -94.9 | -1.56 | -0.61 | -0.25 |
| 103 | C09 | Max | 606.7 | 297.6 | 132.8 | 1.57 | 0.77 | 0.34 |
| 103 | C09 | Min | -606.7 | -297.6 | -132.8 | -1.57 | -0.77 | -0.34 |
| 104 | C09 | Max | 607.8 | 289.9 | 150.0 | 1.57 | 0.75 | 0.39 |
| 104 | C09 | Min | -607.8 | -289.9 | -150.0 | -1.57 | -0.75 | -0.39 |

| CASE-09: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C09 | Max | 607.5 | 278.4 | 147.1 | 1.57 | 0.72 | 0.38 |
| 105 | C09 | Min | -607.5 | -278.4 | -147.1 | -1.57 | -0.72 | -0.38 |
| 106 | C09 | Max | 604.7 | 333.0 | 124.2 | 1.57 | 0.86 | 0.32 |
| 106 | C09 | Min | -604.7 | -333.0 | -124.2 | -1.57 | -0.86 | -0.32 |
| 107 | C09 | Max | 603.8 | 323.1 | 109.1 | 1.56 | 0.84 | 0.28 |
| 107 | C09 | Min | -603.8 | -323.1 | -109.1 | -1.56 | -0.84 | -0.28 |
| 108 | C09 | Max | 610.9 | 146.7 | 76.7 | 1.58 | 0.38 | 0.20 |
| 108 | C09 | Min | -610.9 | -146.7 | -76.7 | -1.58 | -0.38 | -0.20 |
| 109 | C09 | Max | 608.4 | 279.6 | 60.6 | 1.58 | 0.72 | 0.16 |
| 109 | C09 | Min | -608.4 | -279.6 | -60.6 | -1.58 | -0.72 | -0.16 |
| 110 | C09 | Max | 608.2 | 275.9 | 60.6 | 1.57 | 0.71 | 0.16 |
| 110 | C09 | Min | -608.2 | -275.9 | -60.6 | -1.57 | -0.71 | -0.16 |
| 200 | C09 | Max | 567.7 | 275.7 | 49.1 | 1.47 | 0.71 | 0.13 |
| 200 | C09 | Min | -567.7 | -275.7 | -49.1 | -1.47 | -0.71 | -0.13 |
| 201 | C09 | Max | 568.4 | 275.6 | 49.1 | 1.47 | 0.71 | 0.13 |
| 201 | C09 | Min | -568.4 | -275.6 | -49.1 | -1.47 | -0.71 | -0.13 |
| 202 | C09 | Max | 570.8 | 251.6 | 83.2 | 1.48 | 0.65 | 0.22 |
| 202 | C09 | Min | -570.8 | -251.6 | -83.2 | -1.48 | -0.65 | -0.22 |
| 203 | C09 | Max | 570.3 | 305.7 | 117.5 | 1.48 | 0.79 | 0.30 |
| 203 | C09 | Min | -570.3 | -305.7 | -117.5 | -1.48 | -0.79 | -0.30 |
| 204 | C09 | Max | 567.2 | 280.5 | 139.5 | 1.47 | 0.73 | 0.36 |
| 204 | C09 | Min | -567.2 | -280.5 | -139.5 | -1.47 | -0.73 | -0.36 |
| 205 | C09 | Max | 566.3 | 266.3 | 140.2 | 1.47 | 0.69 | 0.36 |
| 205 | C09 | Min | -566.3 | -266.3 | -140.2 | -1.47 | -0.69 | -0.36 |
| 206 | C09 | Max | 572.2 | 278.3 | 130.2 | 1.48 | 0.72 | 0.34 |
| 206 | C09 | Min | -572.2 | -278.3 | -130.2 | -1.48 | -0.72 | -0.34 |
| 207 | C09 | Max | 578.5 | 255.8 | 121.2 | 1.50 | 0.66 | 0.31 |
| 207 | C09 | Min | -578.5 | -255.8 | -121.2 | -1.50 | -0.66 | -0.31 |
| 208 | C09 | Max | 590.5 | 114.1 | 90.1 | 1.53 | 0.30 | 0.23 |
| 208 | C09 | Min | -590.5 | -114.1 | -90.1 | -1.53 | -0.30 | -0.23 |
| 209 | C09 | Max | 587.3 | 264.4 | 52.5 | 1.52 | 0.68 | 0.14 |
| 209 | C09 | Min | -587.3 | -264.4 | -52.5 | -1.52 | -0.68 | -0.14 |
| 210 | C09 | Max | 587.6 | 263.4 | 52.4 | 1.52 | 0.68 | 0.14 |
| 210 | C09 | Min | -587.6 | -263.4 | -52.4 | -1.52 | -0.68 | -0.14 |
| 301 | C09 | Max | 482.5 | 279.8 | 76.8 | 1.25 | 0.72 | 0.20 |
| 301 | C09 | Min | -482.5 | -279.8 | -76.8 | -1.25 | -0.72 | -0.20 |
| 302 | C09 | Max | 444.4 | 276.9 | 90.2 | 1.15 | 0.72 | 0.23 |
| 302 | C09 | Min | -444.4 | -276.9 | -90.2 | -1.15 | -0.72 | -0.23 |
| 303 | C09 | Max | 450.6 | 266.2 | 60.7 | 1.17 | 0.69 | 0.16 |
| 303 | C09 | Min | -450.6 | -266.2 | -60.7 | -1.17 | -0.69 | -0.16 |
| 304 | C09 | Max | 420.7 | 264.4 | 52.5 | 1.09 | 0.68 | 0.14 |
| 304 | C09 | Min | -420.7 | -264.4 | -52.5 | -1.09 | -0.68 | -0.14 |
| 401 | C09 | Max | 488.4 | 278.6 | 76.8 | 1.26 | 0.72 | 0.20 |
| 401 | C09 | Min | -488.4 | -278.6 | -76.8 | -1.26 | -0.72 | -0.20 |
| 402 | C09 | Max | 442.8 | 273.9 | 90.2 | 1.15 | 0.71 | 0.23 |
| 402 | C09 | Min | -442.8 | -273.9 | -90.2 | -1.15 | -0.71 | -0.23 |
| 500 | C09 | Max | 2.7 | 1.8 | 211.8 | 0.01 | 0.00 | 0.55 |
| 500 | C09 | Min | -2.7 | -1.8 | -211.8 | -0.01 | 0.00 | -0.55 |

| CASE-09: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C09 | Max | 39.6 | 77.2 | 67.6 | 0.10 | 0.20 | 0.18 |
| 501 | C09 | Min | -39.6 | -77.2 | -67.6 | -0.10 | -0.20 | -0.18 |
| 600 | C09 | Max | 30.5 | 21.1 | 81.3 | 0.08 | 0.05 | 0.21 |
| 600 | C09 | Min | -30.5 | -21.1 | -81.3 | -0.08 | -0.05 | -0.21 |
| 601 | C09 | Max | 39.7 | 206.6 | 76.5 | 0.10 | 0.53 | 0.20 |
| 601 | C09 | Min | -39.7 | -206.6 | -76.5 | -0.10 | -0.53 | -0.20 |
| 701 | C09 | Max | 627.9 | 278.5 | 76.7 | 1.63 | 0.72 | 0.20 |
| 701 | C09 | Min | -627.9 | -278.5 | -76.7 | -1.63 | -0.72 | -0.20 |
| 702 | C09 | Max | 606.0 | 273.8 | 90.1 | 1.57 | 0.71 | 0.23 |
| 702 | C09 | Min | -606.0 | -273.8 | -90.1 | -1.57 | -0.71 | -0.23 |
| 703 | C09 | Max | 607.6 | 265.8 | 60.7 | 1.57 | 0.69 | 0.16 |
| 703 | C09 | Min | -607.6 | -265.8 | -60.7 | -1.57 | -0.69 | -0.16 |
| 704 | C09 | Max | 588.7 | 262.8 | 52.5 | 1.52 | 0.68 | 0.14 |
| 704 | C09 | Min | -588.7 | -262.8 | -52.5 | -1.52 | -0.68 | -0.14 |
| 801 | C09 | Max | 595.1 | 303.2 | 57.5 | 1.54 | 0.78 | 0.15 |
| 801 | C09 | Min | -595.1 | -303.2 | -57.5 | -1.54 | -0.78 | -0.15 |
| 802 | C09 | Max | 591.1 | 286.0 | 169.0 | 1.53 | 0.74 | 0.44 |
| 802 | C09 | Min | -591.1 | -286.0 | -169.0 | -1.53 | -0.74 | -0.44 |
| 803 | C09 | Max | 566.7 | 275.9 | 49.1 | 1.47 | 0.71 | 0.13 |
| 803 | C09 | Min | -566.7 | -275.9 | -49.1 | -1.47 | -0.71 | -0.13 |
| 804 | C09 | Max | 607.7 | 268.2 | 60.6 | 1.57 | 0.69 | 0.16 |
| 804 | C09 | Min | -607.7 | -268.2 | -60.6 | -1.57 | -0.69 | -0.16 |
| 805 | C09 | Max | 590.8 | 262.7 | 149.3 | 1.53 | 0.68 | 0.39 |
| 805 | C09 | Min | -590.8 | -262.7 | -149.3 | -1.53 | -0.68 | -0.39 |
| 806 | C09 | Max | 588.4 | 262.4 | 52.4 | 1.52 | 0.68 | 0.14 |
| 806 | C09 | Min | -588.4 | -262.4 | -52.4 | -1.52 | -0.68 | -0.14 |
| | **C09** | **MAX:** | **627.9** | **333.0** | **211.8** | **1.63** | **0.86** | **0.55** |

## Case-10

| CASE-10: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C10 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C10 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C10 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C10 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C10 | Max | 522.6 | 316.7 | 48.6 | 1.35 | 0.82 | 0.13 |
| 10 | C10 | Min | -522.6 | -316.7 | -48.6 | -1.35 | -0.82 | -0.13 |
| 11 | C10 | Max | 522.6 | 310.9 | 48.6 | 1.35 | 0.81 | 0.13 |
| 11 | C10 | Min | -522.6 | -310.9 | -48.6 | -1.35 | -0.81 | -0.13 |
| 12 | C10 | Max | 522.6 | 314.6 | 48.6 | 1.35 | 0.81 | 0.13 |
| 12 | C10 | Min | -522.6 | -314.6 | -48.6 | -1.35 | -0.81 | -0.13 |
| 13 | C10 | Max | 522.6 | 316.1 | 48.6 | 1.35 | 0.82 | 0.13 |
| 13 | C10 | Min | -522.6 | -316.1 | -48.6 | -1.35 | -0.82 | -0.13 |
| 14 | C10 | Max | 610.9 | 330.5 | 48.5 | 1.58 | 0.86 | 0.13 |
| 14 | C10 | Min | -610.9 | -330.5 | -48.5 | -1.58 | -0.86 | -0.13 |
| 15 | C10 | Max | 601.4 | 320.8 | 48.6 | 1.56 | 0.83 | 0.13 |
| 15 | C10 | Min | -601.4 | -320.8 | -48.6 | -1.56 | -0.83 | -0.13 |
| 16 | C10 | Max | 637.6 | 309.2 | 48.6 | 1.65 | 0.80 | 0.13 |
| 16 | C10 | Min | -637.6 | -309.2 | -48.6 | -1.65 | -0.80 | -0.13 |
| 17 | C10 | Max | 629.4 | 310.6 | 48.6 | 1.63 | 0.80 | 0.13 |
| 17 | C10 | Min | -629.4 | -310.6 | -48.6 | -1.63 | -0.80 | -0.13 |
| 21 | C10 | Max | 549.8 | 313.3 | 48.6 | 1.42 | 0.81 | 0.13 |
| 21 | C10 | Min | -549.8 | -313.3 | -48.6 | -1.42 | -0.81 | -0.13 |
| 22 | C10 | Max | 558.5 | 311.7 | 48.5 | 1.45 | 0.81 | 0.13 |
| 22 | C10 | Min | -558.5 | -311.7 | -48.5 | -1.45 | -0.81 | -0.13 |
| 23 | C10 | Max | 560.3 | 315.6 | 48.5 | 1.45 | 0.82 | 0.13 |
| 23 | C10 | Min | -560.3 | -315.6 | -48.5 | -1.45 | -0.82 | -0.13 |
| 24 | C10 | Max | 560.5 | 315.6 | 48.6 | 1.45 | 0.82 | 0.13 |
| 24 | C10 | Min | -560.5 | -315.6 | -48.6 | -1.45 | -0.82 | -0.13 |
| 25 | C10 | Max | 609.2 | 324.5 | 48.5 | 1.58 | 0.84 | 0.13 |
| 25 | C10 | Min | -609.2 | -324.5 | -48.5 | -1.58 | -0.84 | -0.13 |
| 26 | C10 | Max | 599.7 | 321.8 | 48.6 | 1.55 | 0.83 | 0.13 |
| 26 | C10 | Min | -599.7 | -321.8 | -48.6 | -1.55 | -0.83 | -0.13 |
| 27 | C10 | Max | 640.1 | 309.5 | 48.6 | 1.66 | 0.80 | 0.13 |
| 27 | C10 | Min | -640.1 | -309.5 | -48.6 | -1.66 | -0.80 | -0.13 |
| 28 | C10 | Max | 631.0 | 309.5 | 48.5 | 1.63 | 0.80 | 0.13 |
| 28 | C10 | Min | -631.0 | -309.5 | -48.5 | -1.63 | -0.80 | -0.13 |
| 100 | C10 | Max | 576.5 | 311.7 | 61.2 | 1.49 | 0.81 | 0.16 |
| 100 | C10 | Min | -576.5 | -311.7 | -61.2 | -1.49 | -0.81 | -0.16 |
| 101 | C10 | Max | 575.5 | 311.6 | 61.2 | 1.49 | 0.81 | 0.16 |
| 101 | C10 | Min | -575.5 | -311.6 | -61.2 | -1.49 | -0.81 | -0.16 |
| 102 | C10 | Max | 579.3 | 231.4 | 100.4 | 1.50 | 0.60 | 0.26 |
| 102 | C10 | Min | -579.3 | -231.4 | -100.4 | -1.50 | -0.60 | -0.26 |
| 103 | C10 | Max | 581.9 | 227.7 | 125.3 | 1.51 | 0.59 | 0.32 |
| 103 | C10 | Min | -581.9 | -227.7 | -125.3 | -1.51 | -0.59 | -0.32 |
| 104 | C10 | Max | 584.5 | 179.4 | 97.6 | 1.51 | 0.46 | 0.25 |
| 104 | C10 | Min | -584.5 | -179.4 | -97.6 | -1.51 | -0.46 | -0.25 |
| 105 | C10 | Max | 584.1 | 175.1 | 97.9 | 1.51 | 0.45 | 0.25 |

| CASE-10: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C10 | Min | -584.1 | -175.1 | -97.9 | -1.51 | -0.45 | -0.25 |
| 106 | C10 | Max | 586.1 | 209.4 | 105.1 | 1.52 | 0.54 | 0.27 |
| 106 | C10 | Min | -586.1 | -209.4 | -105.1 | -1.52 | -0.54 | -0.27 |
| 107 | C10 | Max | 588.4 | 291.3 | 116.7 | 1.52 | 0.75 | 0.30 |
| 107 | C10 | Min | -588.4 | -291.3 | -116.7 | -1.52 | -0.75 | -0.30 |
| 108 | C10 | Max | 594.8 | 295.0 | 97.2 | 1.54 | 0.76 | 0.25 |
| 108 | C10 | Min | -594.8 | -295.0 | -97.2 | -1.54 | -0.76 | -0.25 |
| 109 | C10 | Max | 599.8 | 321.7 | 54.3 | 1.55 | 0.83 | 0.14 |
| 109 | C10 | Min | -599.8 | -321.7 | -54.3 | -1.55 | -0.83 | -0.14 |
| 110 | C10 | Max | 598.1 | 321.9 | 54.4 | 1.55 | 0.83 | 0.14 |
| 110 | C10 | Min | -598.1 | -321.9 | -54.4 | -1.55 | -0.83 | -0.14 |
| 200 | C10 | Max | 586.0 | 315.4 | 49.5 | 1.52 | 0.82 | 0.13 |
| 200 | C10 | Min | -586.0 | -315.4 | -49.5 | -1.52 | -0.82 | -0.13 |
| 201 | C10 | Max | 582.8 | 315.9 | 49.6 | 1.51 | 0.82 | 0.13 |
| 201 | C10 | Min | -582.8 | -315.9 | -49.6 | -1.51 | -0.82 | -0.13 |
| 202 | C10 | Max | 587.6 | 290.1 | 106.5 | 1.52 | 0.75 | 0.28 |
| 202 | C10 | Min | -587.6 | -290.1 | -106.5 | -1.52 | -0.75 | -0.28 |
| 203 | C10 | Max | 591.0 | 228.7 | 138.8 | 1.53 | 0.59 | 0.36 |
| 203 | C10 | Min | -591.0 | -228.7 | -138.8 | -1.53 | -0.59 | -0.36 |
| 204 | C10 | Max | 595.5 | 174.1 | 95.4 | 1.54 | 0.45 | 0.25 |
| 204 | C10 | Min | -595.5 | -174.1 | -95.4 | -1.54 | -0.45 | -0.25 |
| 205 | C10 | Max | 594.6 | 168.8 | 88.8 | 1.54 | 0.44 | 0.23 |
| 205 | C10 | Min | -594.6 | -168.8 | -88.8 | -1.54 | -0.44 | -0.23 |
| 206 | C10 | Max | 596.0 | 153.4 | 94.6 | 1.54 | 0.40 | 0.24 |
| 206 | C10 | Min | -596.0 | -153.4 | -94.6 | -1.54 | -0.40 | -0.24 |
| 207 | C10 | Max | 603.8 | 234.8 | 103.5 | 1.56 | 0.61 | 0.27 |
| 207 | C10 | Min | -603.8 | -234.8 | -103.5 | -1.56 | -0.61 | -0.27 |
| 208 | C10 | Max | 615.1 | 335.6 | 86.8 | 1.59 | 0.87 | 0.22 |
| 208 | C10 | Min | -615.1 | -335.6 | -86.8 | -1.59 | -0.87 | -0.22 |
| 209 | C10 | Max | 621.8 | 309.0 | 49.4 | 1.61 | 0.80 | 0.13 |
| 209 | C10 | Min | -621.8 | -309.0 | -49.4 | -1.61 | -0.80 | -0.13 |
| 210 | C10 | Max | 622.8 | 309.5 | 49.4 | 1.61 | 0.80 | 0.13 |
| 210 | C10 | Min | -622.8 | -309.5 | -49.4 | -1.61 | -0.80 | -0.13 |
| 301 | C10 | Max | 344.2 | 211.2 | 97.6 | 0.89 | 0.55 | 0.25 |
| 301 | C10 | Min | -344.2 | -211.2 | -97.6 | -0.89 | -0.55 | -0.25 |
| 302 | C10 | Max | 312.7 | 208.8 | 95.4 | 0.81 | 0.54 | 0.25 |
| 302 | C10 | Min | -312.7 | -208.8 | -95.4 | -0.81 | -0.54 | -0.25 |
| 303 | C10 | Max | 288.4 | 209.9 | 105.1 | 0.75 | 0.54 | 0.27 |
| 303 | C10 | Min | -288.4 | -209.9 | -105.1 | -0.75 | -0.54 | -0.27 |
| 304 | C10 | Max | 276.0 | 209.7 | 94.6 | 0.71 | 0.54 | 0.25 |
| 304 | C10 | Min | -276.0 | -209.7 | -94.6 | -0.71 | -0.54 | -0.25 |
| 401 | C10 | Max | 359.0 | 207.5 | 97.6 | 0.93 | 0.54 | 0.25 |
| 401 | C10 | Min | -359.0 | -207.5 | -97.6 | -0.93 | -0.54 | -0.25 |
| 402 | C10 | Max | 322.2 | 204.1 | 95.4 | 0.83 | 0.53 | 0.25 |
| 402 | C10 | Min | -322.2 | -204.1 | -95.4 | -0.83 | -0.53 | -0.25 |
| 500 | C10 | Max | 16.1 | 18.1 | 78.5 | 0.04 | 0.05 | 0.20 |
| 500 | C10 | Min | -16.1 | -18.1 | -78.5 | -0.04 | -0.05 | -0.20 |
| 501 | C10 | Max | 40.7 | 153.3 | 77.2 | 0.11 | 0.40 | 0.20 |

| CASE-10: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C10 | Min | -40.7 | -153.3 | -77.2 | -0.11 | -0.40 | -0.20 |
| 600 | C10 | Max | 18.0 | 19.6 | 106.1 | 0.05 | 0.05 | 0.27 |
| 600 | C10 | Min | -18.0 | -19.6 | -106.1 | -0.05 | -0.05 | -0.27 |
| 601 | C10 | Max | 40.7 | 185.8 | 83.1 | 0.11 | 0.48 | 0.22 |
| 601 | C10 | Min | -40.7 | -185.8 | -83.1 | -0.11 | -0.48 | -0.22 |
| 701 | C10 | Max | 598.8 | 207.5 | 97.6 | 1.55 | 0.54 | 0.25 |
| 701 | C10 | Min | -598.8 | -207.5 | -97.6 | -1.55 | -0.54 | -0.25 |
| 702 | C10 | Max | 616.3 | 204.1 | 95.4 | 1.60 | 0.53 | 0.25 |
| 702 | C10 | Min | -616.3 | -204.1 | -95.4 | -1.60 | -0.53 | -0.25 |
| 703 | C10 | Max | 587.8 | 205.0 | 105.1 | 1.52 | 0.53 | 0.27 |
| 703 | C10 | Min | -587.8 | -205.0 | -105.1 | -1.52 | -0.53 | -0.27 |
| 704 | C10 | Max | 593.1 | 205.3 | 94.6 | 1.54 | 0.53 | 0.25 |
| 704 | C10 | Min | -593.1 | -205.3 | -94.6 | -1.54 | -0.53 | -0.25 |
| 801 | C10 | Max | 580.9 | 311.8 | 61.2 | 1.50 | 0.81 | 0.16 |
| 801 | C10 | Min | -580.9 | -311.8 | -61.2 | -1.50 | -0.81 | -0.16 |
| 802 | C10 | Max | 603.1 | 312.7 | 150.8 | 1.56 | 0.81 | 0.39 |
| 802 | C10 | Min | -603.1 | -312.7 | -150.8 | -1.56 | -0.81 | -0.39 |
| 803 | C10 | Max | 593.0 | 315.0 | 49.6 | 1.54 | 0.82 | 0.13 |
| 803 | C10 | Min | -593.0 | -315.0 | -49.6 | -1.54 | -0.82 | -0.13 |
| 804 | C10 | Max | 594.7 | 322.2 | 54.4 | 1.54 | 0.83 | 0.14 |
| 804 | C10 | Min | -594.7 | -322.2 | -54.4 | -1.54 | -0.83 | -0.14 |
| 805 | C10 | Max | 636.4 | 315.1 | 130.5 | 1.65 | 0.82 | 0.34 |
| 805 | C10 | Min | -636.4 | -315.1 | -130.5 | -1.65 | -0.82 | -0.34 |
| 806 | C10 | Max | 624.9 | 310.6 | 49.4 | 1.62 | 0.80 | 0.13 |
| 806 | C10 | Min | -624.9 | -310.6 | -49.4 | -1.62 | -0.80 | -0.13 |
| | **C10** | **MAX:** | **640.1** | **335.6** | **150.8** | **1.66** | **0.87** | **0.39** |

**Case-11**

| CASE-11: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C11 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C11 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C11 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C11 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C11 | Max | 522.6 | 340.8 | 48.6 | 1.35 | 0.88 | 0.13 |
| 10 | C11 | Min | -522.6 | -340.8 | -48.6 | -1.35 | -0.88 | -0.13 |
| 11 | C11 | Max | 522.6 | 317.5 | 48.6 | 1.35 | 0.82 | 0.13 |
| 11 | C11 | Min | -522.6 | -317.5 | -48.6 | -1.35 | -0.82 | -0.13 |
| 12 | C11 | Max | 522.6 | 278.8 | 48.6 | 1.35 | 0.72 | 0.13 |
| 12 | C11 | Min | -522.6 | -278.8 | -48.6 | -1.35 | -0.72 | -0.13 |
| 13 | C11 | Max | 522.6 | 282.5 | 48.6 | 1.35 | 0.73 | 0.13 |
| 13 | C11 | Min | -522.6 | -282.5 | -48.6 | -1.35 | -0.73 | -0.13 |
| 14 | C11 | Max | 630.1 | 377.5 | 48.6 | 1.63 | 0.98 | 0.13 |
| 14 | C11 | Min | -630.1 | -377.5 | -48.6 | -1.63 | -0.98 | -0.13 |
| 15 | C11 | Max | 669.9 | 350.9 | 48.6 | 1.73 | 0.91 | 0.13 |
| 15 | C11 | Min | -669.9 | -350.9 | -48.6 | -1.73 | -0.91 | -0.13 |
| 16 | C11 | Max | 616.5 | 314.8 | 48.6 | 1.60 | 0.82 | 0.13 |
| 16 | C11 | Min | -616.5 | -314.8 | -48.6 | -1.60 | -0.82 | -0.13 |
| 17 | C11 | Max | 615.7 | 313.9 | 48.6 | 1.59 | 0.81 | 0.13 |
| 17 | C11 | Min | -615.7 | -313.9 | -48.6 | -1.59 | -0.81 | -0.13 |
| 21 | C11 | Max | 563.7 | 331.3 | 48.6 | 1.46 | 0.86 | 0.13 |
| 21 | C11 | Min | -563.7 | -331.3 | -48.6 | -1.46 | -0.86 | -0.13 |
| 22 | C11 | Max | 554.6 | 323.0 | 48.6 | 1.44 | 0.84 | 0.13 |
| 22 | C11 | Min | -554.6 | -323.0 | -48.6 | -1.44 | -0.84 | -0.13 |
| 23 | C11 | Max | 573.7 | 279.9 | 48.6 | 1.49 | 0.72 | 0.13 |
| 23 | C11 | Min | -573.7 | -279.9 | -48.6 | -1.49 | -0.72 | -0.13 |
| 24 | C11 | Max | 570.2 | 279.9 | 48.5 | 1.48 | 0.72 | 0.13 |
| 24 | C11 | Min | -570.2 | -279.9 | -48.5 | -1.48 | -0.72 | -0.13 |
| 25 | C11 | Max | 627.3 | 365.6 | 48.6 | 1.62 | 0.95 | 0.13 |
| 25 | C11 | Min | -627.3 | -365.6 | -48.6 | -1.62 | -0.95 | -0.13 |
| 26 | C11 | Max | 668.3 | 357.8 | 48.5 | 1.73 | 0.93 | 0.13 |
| 26 | C11 | Min | -668.3 | -357.8 | -48.5 | -1.73 | -0.93 | -0.13 |
| 27 | C11 | Max | 620.4 | 313.5 | 48.5 | 1.61 | 0.81 | 0.13 |
| 27 | C11 | Min | -620.4 | -313.5 | -48.5 | -1.61 | -0.81 | -0.13 |
| 28 | C11 | Max | 612.3 | 313.5 | 48.6 | 1.59 | 0.81 | 0.13 |
| 28 | C11 | Min | -612.3 | -313.5 | -48.6 | -1.59 | -0.81 | -0.13 |
| 100 | C11 | Max | 579.3 | 323.3 | 54.4 | 1.50 | 0.84 | 0.14 |
| 100 | C11 | Min | -579.3 | -323.3 | -54.4 | -1.50 | -0.84 | -0.14 |
| 101 | C11 | Max | 576.4 | 324.2 | 54.4 | 1.49 | 0.84 | 0.14 |
| 101 | C11 | Min | -576.4 | -324.2 | -54.4 | -1.49 | -0.84 | -0.14 |
| 102 | C11 | Max | 582.0 | 256.7 | 108.4 | 1.51 | 0.66 | 0.28 |
| 102 | C11 | Min | -582.0 | -256.7 | -108.4 | -1.51 | -0.66 | -0.28 |
| 103 | C11 | Max | 587.5 | 277.7 | 142.7 | 1.52 | 0.72 | 0.37 |
| 103 | C11 | Min | -587.5 | -277.7 | -142.7 | -1.52 | -0.72 | -0.37 |
| 104 | C11 | Max | 594.0 | 287.9 | 155.2 | 1.54 | 0.75 | 0.40 |
| 104 | C11 | Min | -594.0 | -287.9 | -155.2 | -1.54 | -0.75 | -0.40 |

| CASE-11: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C11 | Max | 595.8 | 285.7 | 154.4 | 1.54 | 0.74 | 0.40 |
| 105 | C11 | Min | -595.8 | -285.7 | -154.4 | -1.54 | -0.74 | -0.40 |
| 106 | C11 | Max | 607.7 | 200.6 | 139.0 | 1.57 | 0.52 | 0.36 |
| 106 | C11 | Min | -607.7 | -200.6 | -139.0 | -1.57 | -0.52 | -0.36 |
| 107 | C11 | Max | 614.9 | 141.9 | 121.5 | 1.59 | 0.37 | 0.31 |
| 107 | C11 | Min | -614.9 | -141.9 | -121.5 | -1.59 | -0.37 | -0.31 |
| 108 | C11 | Max | 616.6 | 198.5 | 95.7 | 1.60 | 0.51 | 0.25 |
| 108 | C11 | Min | -616.6 | -198.5 | -95.7 | -1.60 | -0.51 | -0.25 |
| 109 | C11 | Max | 617.3 | 359.8 | 59.2 | 1.60 | 0.93 | 0.15 |
| 109 | C11 | Min | -617.3 | -359.8 | -59.2 | -1.60 | -0.93 | -0.15 |
| 110 | C11 | Max | 616.4 | 358.2 | 59.2 | 1.60 | 0.93 | 0.15 |
| 110 | C11 | Min | -616.4 | -358.2 | -59.2 | -1.60 | -0.93 | -0.15 |
| 200 | C11 | Max | 599.3 | 280.0 | 51.4 | 1.55 | 0.72 | 0.13 |
| 200 | C11 | Min | -599.3 | -280.0 | -51.4 | -1.55 | -0.72 | -0.13 |
| 201 | C11 | Max | 596.1 | 278.6 | 51.4 | 1.54 | 0.72 | 0.13 |
| 201 | C11 | Min | -596.1 | -278.6 | -51.4 | -1.54 | -0.72 | -0.13 |
| 202 | C11 | Max | 599.6 | 288.5 | 102.7 | 1.55 | 0.75 | 0.27 |
| 202 | C11 | Min | -599.6 | -288.5 | -102.7 | -1.55 | -0.75 | -0.27 |
| 203 | C11 | Max | 599.2 | 303.8 | 126.6 | 1.55 | 0.79 | 0.33 |
| 203 | C11 | Min | -599.2 | -303.8 | -126.6 | -1.55 | -0.79 | -0.33 |
| 204 | C11 | Max | 595.7 | 335.2 | 148.5 | 1.54 | 0.87 | 0.38 |
| 204 | C11 | Min | -595.7 | -335.2 | -148.5 | -1.54 | -0.87 | -0.38 |
| 205 | C11 | Max | 595.2 | 320.9 | 148.9 | 1.54 | 0.83 | 0.39 |
| 205 | C11 | Min | -595.2 | -320.9 | -148.9 | -1.54 | -0.83 | -0.39 |
| 206 | C11 | Max | 595.0 | 209.3 | 136.8 | 1.54 | 0.54 | 0.35 |
| 206 | C11 | Min | -595.0 | -209.3 | -136.8 | -1.54 | -0.54 | -0.35 |
| 207 | C11 | Max | 598.7 | 140.2 | 128.5 | 1.55 | 0.36 | 0.33 |
| 207 | C11 | Min | -598.7 | -140.2 | -128.5 | -1.55 | -0.36 | -0.33 |
| 208 | C11 | Max | 593.0 | 210.8 | 100.7 | 1.54 | 0.55 | 0.26 |
| 208 | C11 | Min | -593.0 | -210.8 | -100.7 | -1.54 | -0.55 | -0.26 |
| 209 | C11 | Max | 593.1 | 313.5 | 51.3 | 1.54 | 0.81 | 0.13 |
| 209 | C11 | Min | -593.1 | -313.5 | -51.3 | -1.54 | -0.81 | -0.13 |
| 210 | C11 | Max | 593.0 | 313.6 | 51.3 | 1.54 | 0.81 | 0.13 |
| 210 | C11 | Min | -593.0 | -313.6 | -51.3 | -1.54 | -0.81 | -0.13 |
| 301 | C11 | Max | 462.0 | 263.6 | 121.4 | 1.20 | 0.68 | 0.31 |
| 301 | C11 | Min | -462.0 | -263.6 | -121.4 | -1.20 | -0.68 | -0.31 |
| 302 | C11 | Max | 469.2 | 264.0 | 128.4 | 1.22 | 0.68 | 0.33 |
| 302 | C11 | Min | -469.2 | -264.0 | -128.4 | -1.22 | -0.68 | -0.33 |
| 303 | C11 | Max | 418.8 | 290.6 | 95.8 | 1.08 | 0.75 | 0.25 |
| 303 | C11 | Min | -418.8 | -290.6 | -95.8 | -1.08 | -0.75 | -0.25 |
| 304 | C11 | Max | 424.9 | 290.4 | 100.8 | 1.10 | 0.75 | 0.26 |
| 304 | C11 | Min | -424.9 | -290.4 | -100.8 | -1.10 | -0.75 | -0.26 |
| 401 | C11 | Max | 472.7 | 266.6 | 121.4 | 1.22 | 0.69 | 0.31 |
| 401 | C11 | Min | -472.7 | -266.6 | -121.4 | -1.22 | -0.69 | -0.31 |
| 402 | C11 | Max | 475.7 | 268.1 | 128.4 | 1.23 | 0.69 | 0.33 |
| 402 | C11 | Min | -475.7 | -268.1 | -128.4 | -1.23 | -0.69 | -0.33 |
| 500 | C11 | Max | 15.8 | 16.9 | 76.9 | 0.04 | 0.04 | 0.20 |
| 500 | C11 | Min | -15.8 | -16.9 | -76.9 | -0.04 | -0.04 | -0.20 |

| CASE-11: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C11 | Max | 40.6 | 92.3 | 74.4 | 0.11 | 0.24 | 0.19 |
| 501 | C11 | Min | -40.6 | -92.3 | -74.4 | -0.11 | -0.24 | -0.19 |
| 600 | C11 | Max | 17.6 | 16.6 | 88.1 | 0.05 | 0.04 | 0.23 |
| 600 | C11 | Min | -17.6 | -16.6 | -88.1 | -0.05 | -0.04 | -0.23 |
| 601 | C11 | Max | 40.6 | 199.4 | 79.9 | 0.11 | 0.52 | 0.21 |
| 601 | C11 | Min | -40.6 | -199.4 | -79.9 | -0.11 | -0.52 | -0.21 |
| 701 | C11 | Max | 622.9 | 266.4 | 121.5 | 1.61 | 0.69 | 0.31 |
| 701 | C11 | Min | -622.9 | -266.4 | -121.5 | -1.61 | -0.69 | -0.31 |
| 702 | C11 | Max | 610.8 | 268.0 | 128.5 | 1.58 | 0.69 | 0.33 |
| 702 | C11 | Min | -610.8 | -268.0 | -128.5 | -1.58 | -0.69 | -0.33 |
| 703 | C11 | Max | 611.0 | 284.4 | 95.8 | 1.58 | 0.74 | 0.25 |
| 703 | C11 | Min | -611.0 | -284.4 | -95.8 | -1.58 | -0.74 | -0.25 |
| 704 | C11 | Max | 592.4 | 282.8 | 100.8 | 1.53 | 0.73 | 0.26 |
| 704 | C11 | Min | -592.4 | -282.8 | -100.8 | -1.53 | -0.73 | -0.26 |
| 801 | C11 | Max | 587.0 | 321.2 | 54.4 | 1.52 | 0.83 | 0.14 |
| 801 | C11 | Min | -587.0 | -321.2 | -54.4 | -1.52 | -0.83 | -0.14 |
| 802 | C11 | Max | 601.3 | 298.3 | 327.3 | 1.56 | 0.77 | 0.85 |
| 802 | C11 | Min | -601.3 | -298.3 | -327.3 | -1.56 | -0.77 | -0.85 |
| 803 | C11 | Max | 606.9 | 283.3 | 51.4 | 1.57 | 0.73 | 0.13 |
| 803 | C11 | Min | -606.9 | -283.3 | -51.4 | -1.57 | -0.73 | -0.13 |
| 804 | C11 | Max | 617.5 | 354.4 | 59.2 | 1.60 | 0.92 | 0.15 |
| 804 | C11 | Min | -617.5 | -354.4 | -59.2 | -1.60 | -0.92 | -0.15 |
| 805 | C11 | Max | 609.8 | 334.1 | 330.4 | 1.58 | 0.86 | 0.86 |
| 805 | C11 | Min | -609.8 | -334.1 | -330.4 | -1.58 | -0.86 | -0.86 |
| 806 | C11 | Max | 592.7 | 316.6 | 51.3 | 1.53 | 0.82 | 0.13 |
| 806 | C11 | Min | -592.7 | -316.6 | -51.3 | -1.53 | -0.82 | -0.13 |
| | **C11** | **MAX:** | **669.9** | **377.5** | **330.4** | **1.73** | **0.98** | **0.86** |

**Case-12**

| CASE-12: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C12 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C12 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C12 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C12 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C12 | Max | 522.6 | 319.1 | 48.5 | 1.35 | 0.83 | 0.13 |
| 10 | C12 | Min | -522.6 | -319.1 | -48.5 | -1.35 | -0.83 | -0.13 |
| 11 | C12 | Max | 522.6 | 300.7 | 48.6 | 1.35 | 0.78 | 0.13 |
| 11 | C12 | Min | -522.6 | -300.7 | -48.6 | -1.35 | -0.78 | -0.13 |
| 12 | C12 | Max | 522.6 | 283.1 | 48.6 | 1.35 | 0.73 | 0.13 |
| 12 | C12 | Min | -522.6 | -283.1 | -48.6 | -1.35 | -0.73 | -0.13 |
| 13 | C12 | Max | 522.6 | 281.0 | 48.6 | 1.35 | 0.73 | 0.13 |
| 13 | C12 | Min | -522.6 | -281.0 | -48.6 | -1.35 | -0.73 | -0.13 |
| 14 | C12 | Max | 620.7 | 315.1 | 48.6 | 1.61 | 0.82 | 0.13 |
| 14 | C12 | Min | -620.7 | -315.1 | -48.6 | -1.61 | -0.82 | -0.13 |
| 15 | C12 | Max | 598.2 | 264.9 | 48.6 | 1.55 | 0.69 | 0.13 |
| 15 | C12 | Min | -598.2 | -264.9 | -48.6 | -1.55 | -0.69 | -0.13 |
| 16 | C12 | Max | 617.2 | 249.0 | 48.6 | 1.60 | 0.64 | 0.13 |
| 16 | C12 | Min | -617.2 | -249.0 | -48.6 | -1.60 | -0.64 | -0.13 |
| 17 | C12 | Max | 606.3 | 252.3 | 48.6 | 1.57 | 0.65 | 0.13 |
| 17 | C12 | Min | -606.3 | -252.3 | -48.6 | -1.57 | -0.65 | -0.13 |
| 21 | C12 | Max | 559.2 | 309.7 | 48.5 | 1.45 | 0.80 | 0.13 |
| 21 | C12 | Min | -559.2 | -309.7 | -48.5 | -1.45 | -0.80 | -0.13 |
| 22 | C12 | Max | 559.3 | 305.6 | 48.6 | 1.45 | 0.79 | 0.13 |
| 22 | C12 | Min | -559.3 | -305.6 | -48.6 | -1.45 | -0.79 | -0.13 |
| 23 | C12 | Max | 554.3 | 281.9 | 48.6 | 1.44 | 0.73 | 0.13 |
| 23 | C12 | Min | -554.3 | -281.9 | -48.6 | -1.44 | -0.73 | -0.13 |
| 24 | C12 | Max | 552.9 | 281.9 | 48.5 | 1.43 | 0.73 | 0.13 |
| 24 | C12 | Min | -552.9 | -281.9 | -48.5 | -1.43 | -0.73 | -0.13 |
| 25 | C12 | Max | 619.0 | 292.7 | 48.6 | 1.60 | 0.76 | 0.13 |
| 25 | C12 | Min | -619.0 | -292.7 | -48.6 | -1.60 | -0.76 | -0.13 |
| 26 | C12 | Max | 597.6 | 274.2 | 48.5 | 1.55 | 0.71 | 0.13 |
| 26 | C12 | Min | -597.6 | -274.2 | -48.5 | -1.55 | -0.71 | -0.13 |
| 27 | C12 | Max | 617.8 | 250.5 | 48.6 | 1.60 | 0.65 | 0.13 |
| 27 | C12 | Min | -617.8 | -250.5 | -48.6 | -1.60 | -0.65 | -0.13 |
| 28 | C12 | Max | 606.2 | 250.5 | 48.6 | 1.57 | 0.65 | 0.13 |
| 28 | C12 | Min | -606.2 | -250.5 | -48.6 | -1.57 | -0.65 | -0.13 |
| 100 | C12 | Max | 585.8 | 305.7 | 52.9 | 1.52 | 0.79 | 0.14 |
| 100 | C12 | Min | -585.8 | -305.7 | -52.9 | -1.52 | -0.79 | -0.14 |
| 101 | C12 | Max | 585.6 | 306.1 | 52.9 | 1.52 | 0.79 | 0.14 |
| 101 | C12 | Min | -585.6 | -306.1 | -52.9 | -1.52 | -0.79 | -0.14 |
| 102 | C12 | Max | 588.7 | 252.4 | 97.2 | 1.52 | 0.65 | 0.25 |
| 102 | C12 | Min | -588.7 | -252.4 | -97.2 | -1.52 | -0.65 | -0.25 |
| 103 | C12 | Max | 588.5 | 334.3 | 139.3 | 1.52 | 0.87 | 0.36 |
| 103 | C12 | Min | -588.5 | -334.3 | -139.3 | -1.52 | -0.87 | -0.36 |
| 104 | C12 | Max | 588.4 | 266.3 | 160.5 | 1.52 | 0.69 | 0.42 |
| 104 | C12 | Min | -588.4 | -266.3 | -160.5 | -1.52 | -0.69 | -0.42 |

| CASE-12: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C12 | Max | 589.3 | 274.5 | 158.3 | 1.53 | 0.71 | 0.41 |
| 105 | C12 | Min | -589.3 | -274.5 | -158.3 | -1.53 | -0.71 | -0.41 |
| 106 | C12 | Max | 592.1 | 311.9 | 131.1 | 1.53 | 0.81 | 0.34 |
| 106 | C12 | Min | -592.1 | -311.9 | -131.1 | -1.53 | -0.81 | -0.34 |
| 107 | C12 | Max | 594.7 | 257.7 | 109.1 | 1.54 | 0.67 | 0.28 |
| 107 | C12 | Min | -594.7 | -257.7 | -109.1 | -1.54 | -0.67 | -0.28 |
| 108 | C12 | Max | 607.2 | 113.9 | 78.7 | 1.57 | 0.30 | 0.20 |
| 108 | C12 | Min | -607.2 | -113.9 | -78.7 | -1.57 | -0.30 | -0.20 |
| 109 | C12 | Max | 602.8 | 285.1 | 57.2 | 1.56 | 0.74 | 0.15 |
| 109 | C12 | Min | -602.8 | -285.1 | -57.2 | -1.56 | -0.74 | -0.15 |
| 110 | C12 | Max | 602.2 | 274.6 | 57.2 | 1.56 | 0.71 | 0.15 |
| 110 | C12 | Min | -602.2 | -274.6 | -57.2 | -1.56 | -0.71 | -0.15 |
| 200 | C12 | Max | 579.2 | 281.9 | 49.4 | 1.50 | 0.73 | 0.13 |
| 200 | C12 | Min | -579.2 | -281.9 | -49.4 | -1.50 | -0.73 | -0.13 |
| 201 | C12 | Max | 580.5 | 281.7 | 49.4 | 1.50 | 0.73 | 0.13 |
| 201 | C12 | Min | -580.5 | -281.7 | -49.4 | -1.50 | -0.73 | -0.13 |
| 202 | C12 | Max | 582.9 | 233.6 | 86.4 | 1.51 | 0.60 | 0.22 |
| 202 | C12 | Min | -582.9 | -233.6 | -86.4 | -1.51 | -0.60 | -0.22 |
| 203 | C12 | Max | 583.0 | 270.5 | 120.4 | 1.51 | 0.70 | 0.31 |
| 203 | C12 | Min | -583.0 | -270.5 | -120.4 | -1.51 | -0.70 | -0.31 |
| 204 | C12 | Max | 586.9 | 278.6 | 131.9 | 1.52 | 0.72 | 0.34 |
| 204 | C12 | Min | -586.9 | -278.6 | -131.9 | -1.52 | -0.72 | -0.34 |
| 205 | C12 | Max | 588.0 | 271.8 | 129.7 | 1.52 | 0.70 | 0.34 |
| 205 | C12 | Min | -588.0 | -271.8 | -129.7 | -1.52 | -0.70 | -0.34 |
| 206 | C12 | Max | 592.9 | 290.6 | 119.3 | 1.54 | 0.75 | 0.31 |
| 206 | C12 | Min | -592.9 | -290.6 | -119.3 | -1.54 | -0.75 | -0.31 |
| 207 | C12 | Max | 597.5 | 240.6 | 112.6 | 1.55 | 0.62 | 0.29 |
| 207 | C12 | Min | -597.5 | -240.6 | -112.6 | -1.55 | -0.62 | -0.29 |
| 208 | C12 | Max | 604.8 | 125.0 | 84.6 | 1.57 | 0.32 | 0.22 |
| 208 | C12 | Min | -604.8 | -125.0 | -84.6 | -1.57 | -0.32 | -0.22 |
| 209 | C12 | Max | 605.5 | 250.5 | 55.7 | 1.57 | 0.65 | 0.14 |
| 209 | C12 | Min | -605.5 | -250.5 | -55.7 | -1.57 | -0.65 | -0.14 |
| 210 | C12 | Max | 606.0 | 250.6 | 55.7 | 1.57 | 0.65 | 0.14 |
| 210 | C12 | Min | -606.0 | -250.6 | -55.7 | -1.57 | -0.65 | -0.14 |
| 301 | C12 | Max | 453.0 | 255.6 | 78.8 | 1.17 | 0.66 | 0.20 |
| 301 | C12 | Min | -453.0 | -255.6 | -78.8 | -1.17 | -0.66 | -0.20 |
| 302 | C12 | Max | 429.1 | 255.8 | 84.7 | 1.11 | 0.66 | 0.22 |
| 302 | C12 | Min | -429.1 | -255.8 | -84.7 | -1.11 | -0.66 | -0.22 |
| 303 | C12 | Max | 433.6 | 255.7 | 57.3 | 1.12 | 0.66 | 0.15 |
| 303 | C12 | Min | -433.6 | -255.7 | -57.3 | -1.12 | -0.66 | -0.15 |
| 304 | C12 | Max | 399.7 | 252.3 | 55.9 | 1.03 | 0.65 | 0.14 |
| 304 | C12 | Min | -399.7 | -252.3 | -55.9 | -1.03 | -0.65 | -0.14 |
| 401 | C12 | Max | 456.8 | 256.9 | 78.8 | 1.18 | 0.67 | 0.20 |
| 401 | C12 | Min | -456.8 | -256.9 | -78.8 | -1.18 | -0.67 | -0.20 |
| 402 | C12 | Max | 435.9 | 255.7 | 84.6 | 1.13 | 0.66 | 0.22 |
| 402 | C12 | Min | -435.9 | -255.7 | -84.6 | -1.13 | -0.66 | -0.22 |
| 500 | C12 | Max | 16.6 | 16.1 | 82.9 | 0.04 | 0.04 | 0.21 |
| 500 | C12 | Min | -16.6 | -16.1 | -82.9 | -0.04 | -0.04 | -0.21 |

| CASE-12: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C12 | Max | 40.6 | 76.1 | 69.5 | 0.11 | 0.20 | 0.18 |
| 501 | C12 | Min | -40.6 | -76.1 | -69.5 | -0.11 | -0.20 | -0.18 |
| 600 | C12 | Max | 18.4 | 16.6 | 82.9 | 0.05 | 0.04 | 0.21 |
| 600 | C12 | Min | -18.4 | -16.6 | -82.9 | -0.05 | -0.04 | -0.21 |
| 601 | C12 | Max | 40.7 | 187.7 | 76.2 | 0.11 | 0.49 | 0.20 |
| 601 | C12 | Min | -40.7 | -187.7 | -76.2 | -0.11 | -0.49 | -0.20 |
| 701 | C12 | Max | 623.2 | 256.7 | 78.7 | 1.61 | 0.66 | 0.20 |
| 701 | C12 | Min | -623.2 | -256.7 | -78.7 | -1.61 | -0.66 | -0.20 |
| 702 | C12 | Max | 608.5 | 255.5 | 84.6 | 1.58 | 0.66 | 0.22 |
| 702 | C12 | Min | -608.5 | -255.5 | -84.6 | -1.58 | -0.66 | -0.22 |
| 703 | C12 | Max | 601.5 | 254.7 | 57.3 | 1.56 | 0.66 | 0.15 |
| 703 | C12 | Min | -601.5 | -254.7 | -57.3 | -1.56 | -0.66 | -0.15 |
| 704 | C12 | Max | 607.3 | 251.6 | 55.8 | 1.57 | 0.65 | 0.14 |
| 704 | C12 | Min | -607.3 | -251.6 | -55.8 | -1.57 | -0.65 | -0.14 |
| 801 | C12 | Max | 586.4 | 304.8 | 52.9 | 1.52 | 0.79 | 0.14 |
| 801 | C12 | Min | -586.4 | -304.8 | -52.9 | -1.52 | -0.79 | -0.14 |
| 802 | C12 | Max | 595.4 | 294.2 | 108.3 | 1.54 | 0.76 | 0.28 |
| 802 | C12 | Min | -595.4 | -294.2 | -108.3 | -1.54 | -0.76 | -0.28 |
| 803 | C12 | Max | 577.2 | 284.5 | 49.4 | 1.49 | 0.74 | 0.13 |
| 803 | C12 | Min | -577.2 | -284.5 | -49.4 | -1.49 | -0.74 | -0.13 |
| 804 | C12 | Max | 601.7 | 259.7 | 57.2 | 1.56 | 0.67 | 0.15 |
| 804 | C12 | Min | -601.7 | -259.7 | -57.2 | -1.56 | -0.67 | -0.15 |
| 805 | C12 | Max | 596.9 | 252.8 | 110.6 | 1.55 | 0.65 | 0.29 |
| 805 | C12 | Min | -596.9 | -252.8 | -110.6 | -1.55 | -0.65 | -0.29 |
| 806 | C12 | Max | 607.0 | 251.0 | 55.7 | 1.57 | 0.65 | 0.14 |
| 806 | C12 | Min | -607.0 | -251.0 | -55.7 | -1.57 | -0.65 | -0.14 |
| | **C12** | **MAX:** | **623.2** | **334.3** | **160.5** | **1.61** | **0.87** | **0.42** |

**Case-13**

| CASE-13: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint Text | Output Case | Step Type | U1 in/sec2 | U2 in/sec2 | U3 in/sec2 | U1 g | U2 g | U3 g |
| 1 | C13 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C13 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C13 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C13 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C13 | Max | 522.6 | 338.3 | 48.5 | 1.35 | 0.88 | 0.13 |
| 10 | C13 | Min | -522.6 | -338.3 | -48.5 | -1.35 | -0.88 | -0.13 |
| 11 | C13 | Max | 522.6 | 305.3 | 48.6 | 1.35 | 0.79 | 0.13 |
| 11 | C13 | Min | -522.6 | -305.3 | -48.6 | -1.35 | -0.79 | -0.13 |
| 12 | C13 | Max | 522.6 | 315.1 | 48.6 | 1.35 | 0.82 | 0.13 |
| 12 | C13 | Min | -522.6 | -315.1 | -48.6 | -1.35 | -0.82 | -0.13 |
| 13 | C13 | Max | 522.6 | 315.4 | 48.6 | 1.35 | 0.82 | 0.13 |
| 13 | C13 | Min | -522.6 | -315.4 | -48.6 | -1.35 | -0.82 | -0.13 |
| 14 | C13 | Max | 598.0 | 349.5 | 48.6 | 1.55 | 0.90 | 0.13 |
| 14 | C13 | Min | -598.0 | -349.5 | -48.6 | -1.55 | -0.90 | -0.13 |
| 15 | C13 | Max | 599.2 | 331.2 | 48.6 | 1.55 | 0.86 | 0.13 |
| 15 | C13 | Min | -599.2 | -331.2 | -48.6 | -1.55 | -0.86 | -0.13 |
| 16 | C13 | Max | 627.3 | 318.5 | 48.6 | 1.62 | 0.82 | 0.13 |
| 16 | C13 | Min | -627.3 | -318.5 | -48.6 | -1.62 | -0.82 | -0.13 |
| 17 | C13 | Max | 643.0 | 320.1 | 48.6 | 1.67 | 0.83 | 0.13 |
| 17 | C13 | Min | -643.0 | -320.1 | -48.6 | -1.67 | -0.83 | -0.13 |
| 21 | C13 | Max | 552.2 | 319.1 | 48.5 | 1.43 | 0.83 | 0.13 |
| 21 | C13 | Min | -552.2 | -319.1 | -48.5 | -1.43 | -0.83 | -0.13 |
| 22 | C13 | Max | 548.8 | 309.6 | 48.6 | 1.42 | 0.80 | 0.13 |
| 22 | C13 | Min | -548.8 | -309.6 | -48.6 | -1.42 | -0.80 | -0.13 |
| 23 | C13 | Max | 557.1 | 315.8 | 48.6 | 1.44 | 0.82 | 0.13 |
| 23 | C13 | Min | -557.1 | -315.8 | -48.6 | -1.44 | -0.82 | -0.13 |
| 24 | C13 | Max | 558.6 | 315.8 | 48.5 | 1.45 | 0.82 | 0.13 |
| 24 | C13 | Min | -558.6 | -315.8 | -48.5 | -1.45 | -0.82 | -0.13 |
| 25 | C13 | Max | 598.7 | 341.2 | 48.6 | 1.55 | 0.88 | 0.13 |
| 25 | C13 | Min | -598.7 | -341.2 | -48.6 | -1.55 | -0.88 | -0.13 |
| 26 | C13 | Max | 601.4 | 335.3 | 48.5 | 1.56 | 0.87 | 0.13 |
| 26 | C13 | Min | -601.4 | -335.3 | -48.5 | -1.56 | -0.87 | -0.13 |
| 27 | C13 | Max | 628.6 | 319.2 | 48.6 | 1.63 | 0.83 | 0.13 |
| 27 | C13 | Min | -628.6 | -319.2 | -48.6 | -1.63 | -0.83 | -0.13 |
| 28 | C13 | Max | 645.0 | 319.2 | 48.5 | 1.67 | 0.83 | 0.13 |
| 28 | C13 | Min | -645.0 | -319.2 | -48.5 | -1.67 | -0.83 | -0.13 |
| 100 | C13 | Max | 566.8 | 309.9 | 59.5 | 1.47 | 0.80 | 0.15 |
| 100 | C13 | Min | -566.8 | -309.9 | -59.5 | -1.47 | -0.80 | -0.15 |
| 101 | C13 | Max | 566.9 | 310.5 | 59.5 | 1.47 | 0.80 | 0.15 |
| 101 | C13 | Min | -566.9 | -310.5 | -59.5 | -1.47 | -0.80 | -0.15 |
| 102 | C13 | Max | 572.0 | 229.5 | 97.5 | 1.48 | 0.59 | 0.25 |
| 102 | C13 | Min | -572.0 | -229.5 | -97.5 | -1.48 | -0.59 | -0.25 |
| 103 | C13 | Max | 577.0 | 210.7 | 120.8 | 1.49 | 0.55 | 0.31 |
| 103 | C13 | Min | -577.0 | -210.7 | -120.8 | -1.49 | -0.55 | -0.31 |
| 104 | C13 | Max | 586.4 | 183.9 | 101.6 | 1.52 | 0.48 | 0.26 |
| 104 | C13 | Min | -586.4 | -183.9 | -101.6 | -1.52 | -0.48 | -0.26 |

| CASE-13: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C13 | Max | 583.2 | 181.9 | 101.9 | 1.51 | 0.47 | 0.26 |
| 105 | C13 | Min | -583.2 | -181.9 | -101.9 | -1.51 | -0.47 | -0.26 |
| 106 | C13 | Max | 579.7 | 200.7 | 111.5 | 1.50 | 0.52 | 0.29 |
| 106 | C13 | Min | -579.7 | -200.7 | -111.5 | -1.50 | -0.52 | -0.29 |
| 107 | C13 | Max | 580.5 | 269.9 | 105.0 | 1.50 | 0.70 | 0.27 |
| 107 | C13 | Min | -580.5 | -269.9 | -105.0 | -1.50 | -0.70 | -0.27 |
| 108 | C13 | Max | 587.7 | 288.6 | 80.3 | 1.52 | 0.75 | 0.21 |
| 108 | C13 | Min | -587.7 | -288.6 | -80.3 | -1.52 | -0.75 | -0.21 |
| 109 | C13 | Max | 592.3 | 336.1 | 54.5 | 1.53 | 0.87 | 0.14 |
| 109 | C13 | Min | -592.3 | -336.1 | -54.5 | -1.53 | -0.87 | -0.14 |
| 110 | C13 | Max | 593.2 | 335.6 | 54.5 | 1.54 | 0.87 | 0.14 |
| 110 | C13 | Min | -593.2 | -335.6 | -54.5 | -1.54 | -0.87 | -0.14 |
| 200 | C13 | Max | 585.5 | 315.5 | 50.5 | 1.52 | 0.82 | 0.13 |
| 200 | C13 | Min | -585.5 | -315.5 | -50.5 | -1.52 | -0.82 | -0.13 |
| 201 | C13 | Max | 583.5 | 316.8 | 50.5 | 1.51 | 0.82 | 0.13 |
| 201 | C13 | Min | -583.5 | -316.8 | -50.5 | -1.51 | -0.82 | -0.13 |
| 202 | C13 | Max | 587.9 | 289.1 | 102.0 | 1.52 | 0.75 | 0.26 |
| 202 | C13 | Min | -587.9 | -289.1 | -102.0 | -1.52 | -0.75 | -0.26 |
| 203 | C13 | Max | 591.1 | 250.9 | 135.4 | 1.53 | 0.65 | 0.35 |
| 203 | C13 | Min | -591.1 | -250.9 | -135.4 | -1.53 | -0.65 | -0.35 |
| 204 | C13 | Max | 593.9 | 163.6 | 106.5 | 1.54 | 0.42 | 0.28 |
| 204 | C13 | Min | -593.9 | -163.6 | -106.5 | -1.54 | -0.42 | -0.28 |
| 205 | C13 | Max | 595.6 | 162.8 | 100.1 | 1.54 | 0.42 | 0.26 |
| 205 | C13 | Min | -595.6 | -162.8 | -100.1 | -1.54 | -0.42 | -0.26 |
| 206 | C13 | Max | 599.8 | 153.2 | 104.4 | 1.55 | 0.40 | 0.27 |
| 206 | C13 | Min | -599.8 | -153.2 | -104.4 | -1.55 | -0.40 | -0.27 |
| 207 | C13 | Max | 607.9 | 209.5 | 107.5 | 1.57 | 0.54 | 0.28 |
| 207 | C13 | Min | -607.9 | -209.5 | -107.5 | -1.57 | -0.54 | -0.28 |
| 208 | C13 | Max | 617.1 | 308.6 | 88.7 | 1.60 | 0.80 | 0.23 |
| 208 | C13 | Min | -617.1 | -308.6 | -88.7 | -1.60 | -0.80 | -0.23 |
| 209 | C13 | Max | 622.6 | 319.1 | 50.1 | 1.61 | 0.83 | 0.13 |
| 209 | C13 | Min | -622.6 | -319.1 | -50.1 | -1.61 | -0.83 | -0.13 |
| 210 | C13 | Max | 623.3 | 319.2 | 50.1 | 1.61 | 0.83 | 0.13 |
| 210 | C13 | Min | -623.3 | -319.2 | -50.1 | -1.61 | -0.83 | -0.13 |
| 301 | C13 | Max | 383.8 | 208.1 | 101.6 | 0.99 | 0.54 | 0.26 |
| 301 | C13 | Min | -383.8 | -208.1 | -101.6 | -0.99 | -0.54 | -0.26 |
| 302 | C13 | Max | 349.0 | 211.0 | 106.6 | 0.90 | 0.55 | 0.28 |
| 302 | C13 | Min | -349.0 | -211.0 | -106.6 | -0.90 | -0.55 | -0.28 |
| 303 | C13 | Max | 320.6 | 244.6 | 111.5 | 0.83 | 0.63 | 0.29 |
| 303 | C13 | Min | -320.6 | -244.6 | -111.5 | -0.83 | -0.63 | -0.29 |
| 304 | C13 | Max | 300.0 | 245.2 | 104.4 | 0.78 | 0.63 | 0.27 |
| 304 | C13 | Min | -300.0 | -245.2 | -104.4 | -0.78 | -0.63 | -0.27 |
| 401 | C13 | Max | 397.4 | 203.1 | 101.6 | 1.03 | 0.53 | 0.26 |
| 401 | C13 | Min | -397.4 | -203.1 | -101.6 | -1.03 | -0.53 | -0.26 |
| 402 | C13 | Max | 356.7 | 205.8 | 106.6 | 0.92 | 0.53 | 0.28 |
| 402 | C13 | Min | -356.7 | -205.8 | -106.6 | -0.92 | -0.53 | -0.28 |
| 500 | C13 | Max | 20.1 | 21.7 | 80.5 | 0.05 | 0.06 | 0.21 |
| 500 | C13 | Min | -20.1 | -21.7 | -80.5 | -0.05 | -0.06 | -0.21 |

| CASE-13: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C13 | Max | 36.9 | 146.8 | 78.7 | 0.10 | 0.38 | 0.20 |
| 501 | C13 | Min | -36.9 | -146.8 | -78.7 | -0.10 | -0.38 | -0.20 |
| 600 | C13 | Max | 3.3 | 2.2 | 176.7 | 0.01 | 0.01 | 0.46 |
| 600 | C13 | Min | -3.3 | -2.2 | -176.7 | -0.01 | -0.01 | -0.46 |
| 601 | C13 | Max | 37.0 | 179.7 | 81.8 | 0.10 | 0.47 | 0.21 |
| 601 | C13 | Min | -37.0 | -179.7 | -81.8 | -0.10 | -0.47 | -0.21 |
| 701 | C13 | Max | 611.3 | 203.0 | 101.6 | 1.58 | 0.53 | 0.26 |
| 701 | C13 | Min | -611.3 | -203.0 | -101.6 | -1.58 | -0.53 | -0.26 |
| 702 | C13 | Max | 608.5 | 205.7 | 106.5 | 1.58 | 0.53 | 0.28 |
| 702 | C13 | Min | -608.5 | -205.7 | -106.5 | -1.58 | -0.53 | -0.28 |
| 703 | C13 | Max | 580.0 | 239.0 | 111.5 | 1.50 | 0.62 | 0.29 |
| 703 | C13 | Min | -580.0 | -239.0 | -111.5 | -1.50 | -0.62 | -0.29 |
| 704 | C13 | Max | 598.1 | 239.4 | 104.4 | 1.55 | 0.62 | 0.27 |
| 704 | C13 | Min | -598.1 | -239.4 | -104.4 | -1.55 | -0.62 | -0.27 |
| 801 | C13 | Max | 567.2 | 308.5 | 59.5 | 1.47 | 0.80 | 0.15 |
| 801 | C13 | Min | -567.2 | -308.5 | -59.5 | -1.47 | -0.80 | -0.15 |
| 802 | C13 | Max | 574.2 | 304.1 | 301.9 | 1.49 | 0.79 | 0.78 |
| 802 | C13 | Min | -574.2 | -304.1 | -301.9 | -1.49 | -0.79 | -0.78 |
| 803 | C13 | Max | 589.8 | 312.7 | 50.5 | 1.53 | 0.81 | 0.13 |
| 803 | C13 | Min | -589.8 | -312.7 | -50.5 | -1.53 | -0.81 | -0.13 |
| 804 | C13 | Max | 597.1 | 334.4 | 54.5 | 1.55 | 0.87 | 0.14 |
| 804 | C13 | Min | -597.1 | -334.4 | -54.5 | -1.55 | -0.87 | -0.14 |
| 805 | C13 | Max | 624.5 | 322.9 | 299.6 | 1.62 | 0.84 | 0.78 |
| 805 | C13 | Min | -624.5 | -322.9 | -299.6 | -1.62 | -0.84 | -0.78 |
| 806 | C13 | Max | 625.5 | 319.5 | 50.1 | 1.62 | 0.83 | 0.13 |
| 806 | C13 | Min | -625.5 | -319.5 | -50.1 | -1.62 | -0.83 | -0.13 |
| | **C13** | **MAX:** | **645.0** | **349.5** | **301.9** | **1.67** | **0.90** | **0.78** |

**Case-14**

| CASE-14: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C14 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C14 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C14 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C14 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C14 | Max | 522.6 | 389.5 | 48.6 | 1.35 | 1.01 | 0.13 |
| 10 | C14 | Min | -522.6 | -389.5 | -48.6 | -1.35 | -1.01 | -0.13 |
| 11 | C14 | Max | 522.6 | 338.5 | 48.6 | 1.35 | 0.88 | 0.13 |
| 11 | C14 | Min | -522.6 | -338.5 | -48.6 | -1.35 | -0.88 | -0.13 |
| 12 | C14 | Max | 522.6 | 293.3 | 48.6 | 1.35 | 0.76 | 0.13 |
| 12 | C14 | Min | -522.6 | -293.3 | -48.6 | -1.35 | -0.76 | -0.13 |
| 13 | C14 | Max | 522.6 | 291.4 | 48.6 | 1.35 | 0.75 | 0.13 |
| 13 | C14 | Min | -522.6 | -291.4 | -48.6 | -1.35 | -0.75 | -0.13 |
| 14 | C14 | Max | 617.7 | 343.6 | 48.6 | 1.60 | 0.89 | 0.13 |
| 14 | C14 | Min | -617.7 | -343.6 | -48.6 | -1.60 | -0.89 | -0.13 |
| 15 | C14 | Max | 613.9 | 317.6 | 48.6 | 1.59 | 0.82 | 0.13 |
| 15 | C14 | Min | -613.9 | -317.6 | -48.6 | -1.59 | -0.82 | -0.13 |
| 16 | C14 | Max | 614.4 | 300.8 | 48.6 | 1.59 | 0.78 | 0.13 |
| 16 | C14 | Min | -614.4 | -300.8 | -48.6 | -1.59 | -0.78 | -0.13 |
| 17 | C14 | Max | 605.1 | 300.5 | 48.6 | 1.57 | 0.78 | 0.13 |
| 17 | C14 | Min | -605.1 | -300.5 | -48.6 | -1.57 | -0.78 | -0.13 |
| 21 | C14 | Max | 562.0 | 368.4 | 48.6 | 1.46 | 0.95 | 0.13 |
| 21 | C14 | Min | -562.0 | -368.4 | -48.6 | -1.46 | -0.95 | -0.13 |
| 22 | C14 | Max | 569.2 | 351.0 | 48.5 | 1.47 | 0.91 | 0.13 |
| 22 | C14 | Min | -569.2 | -351.0 | -48.5 | -1.47 | -0.91 | -0.13 |
| 23 | C14 | Max | 562.2 | 291.7 | 48.6 | 1.46 | 0.76 | 0.13 |
| 23 | C14 | Min | -562.2 | -291.7 | -48.6 | -1.46 | -0.76 | -0.13 |
| 24 | C14 | Max | 560.2 | 291.7 | 48.6 | 1.45 | 0.76 | 0.13 |
| 24 | C14 | Min | -560.2 | -291.7 | -48.6 | -1.45 | -0.76 | -0.13 |
| 25 | C14 | Max | 614.7 | 332.9 | 48.6 | 1.59 | 0.86 | 0.13 |
| 25 | C14 | Min | -614.7 | -332.9 | -48.6 | -1.59 | -0.86 | -0.13 |
| 26 | C14 | Max | 617.7 | 325.7 | 48.6 | 1.60 | 0.84 | 0.13 |
| 26 | C14 | Min | -617.7 | -325.7 | -48.6 | -1.60 | -0.84 | -0.13 |
| 27 | C14 | Max | 614.1 | 300.6 | 48.6 | 1.59 | 0.78 | 0.13 |
| 27 | C14 | Min | -614.1 | -300.6 | -48.6 | -1.59 | -0.78 | -0.13 |
| 28 | C14 | Max | 603.9 | 300.6 | 48.6 | 1.56 | 0.78 | 0.13 |
| 28 | C14 | Min | -603.9 | -300.6 | -48.6 | -1.56 | -0.78 | -0.13 |
| 100 | C14 | Max | 590.7 | 351.8 | 58.6 | 1.53 | 0.91 | 0.15 |
| 100 | C14 | Min | -590.7 | -351.8 | -58.6 | -1.53 | -0.91 | -0.15 |
| 101 | C14 | Max | 585.3 | 353.8 | 58.6 | 1.52 | 0.92 | 0.15 |
| 101 | C14 | Min | -585.3 | -353.8 | -58.6 | -1.52 | -0.92 | -0.15 |
| 102 | C14 | Max | 587.0 | 283.4 | 118.3 | 1.52 | 0.73 | 0.31 |
| 102 | C14 | Min | -587.0 | -283.4 | -118.3 | -1.52 | -0.73 | -0.31 |
| 103 | C14 | Max | 585.1 | 344.7 | 160.7 | 1.51 | 0.89 | 0.42 |
| 103 | C14 | Min | -585.1 | -344.7 | -160.7 | -1.51 | -0.89 | -0.42 |
| 104 | C14 | Max | 580.8 | 313.6 | 157.9 | 1.50 | 0.81 | 0.41 |
| 104 | C14 | Min | -580.8 | -313.6 | -157.9 | -1.50 | -0.81 | -0.41 |

| CASE-14: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C14 | Max | 582.9 | 316.9 | 153.8 | 1.51 | 0.82 | 0.40 |
| 105 | C14 | Min | -582.9 | -316.9 | -153.8 | -1.51 | -0.82 | -0.40 |
| 106 | C14 | Max | 594.1 | 242.6 | 133.2 | 1.54 | 0.63 | 0.34 |
| 106 | C14 | Min | -594.1 | -242.6 | -133.2 | -1.54 | -0.63 | -0.34 |
| 107 | C14 | Max | 600.6 | 156.8 | 118.7 | 1.56 | 0.41 | 0.31 |
| 107 | C14 | Min | -600.6 | -156.8 | -118.7 | -1.56 | -0.41 | -0.31 |
| 108 | C14 | Max | 600.6 | 179.3 | 95.0 | 1.56 | 0.46 | 0.25 |
| 108 | C14 | Min | -600.6 | -179.3 | -95.0 | -1.56 | -0.46 | -0.25 |
| 109 | C14 | Max | 601.2 | 327.7 | 64.5 | 1.56 | 0.85 | 0.17 |
| 109 | C14 | Min | -601.2 | -327.7 | -64.5 | -1.56 | -0.85 | -0.17 |
| 110 | C14 | Max | 598.2 | 326.0 | 64.4 | 1.55 | 0.84 | 0.17 |
| 110 | C14 | Min | -598.2 | -326.0 | -64.4 | -1.55 | -0.84 | -0.17 |
| 200 | C14 | Max | 583.2 | 291.7 | 53.1 | 1.51 | 0.76 | 0.14 |
| 200 | C14 | Min | -583.2 | -291.7 | -53.1 | -1.51 | -0.76 | -0.14 |
| 201 | C14 | Max | 578.8 | 290.6 | 53.1 | 1.50 | 0.75 | 0.14 |
| 201 | C14 | Min | -578.8 | -290.6 | -53.1 | -1.50 | -0.75 | -0.14 |
| 202 | C14 | Max | 583.0 | 324.7 | 125.7 | 1.51 | 0.84 | 0.33 |
| 202 | C14 | Min | -583.0 | -324.7 | -125.7 | -1.51 | -0.84 | -0.33 |
| 203 | C14 | Max | 586.4 | 337.7 | 158.6 | 1.52 | 0.87 | 0.41 |
| 203 | C14 | Min | -586.4 | -337.7 | -158.6 | -1.52 | -0.87 | -0.41 |
| 204 | C14 | Max | 588.6 | 370.1 | 162.2 | 1.52 | 0.96 | 0.42 |
| 204 | C14 | Min | -588.6 | -370.1 | -162.2 | -1.52 | -0.96 | -0.42 |
| 205 | C14 | Max | 588.7 | 353.3 | 159.1 | 1.52 | 0.91 | 0.41 |
| 205 | C14 | Min | -588.7 | -353.3 | -159.1 | -1.52 | -0.91 | -0.41 |
| 206 | C14 | Max | 591.6 | 218.1 | 133.5 | 1.53 | 0.56 | 0.35 |
| 206 | C14 | Min | -591.6 | -218.1 | -133.5 | -1.53 | -0.56 | -0.35 |
| 207 | C14 | Max | 595.1 | 122.2 | 114.4 | 1.54 | 0.32 | 0.30 |
| 207 | C14 | Min | -595.1 | -122.2 | -114.4 | -1.54 | -0.32 | -0.30 |
| 208 | C14 | Max | 593.2 | 226.8 | 93.0 | 1.54 | 0.59 | 0.24 |
| 208 | C14 | Min | -593.2 | -226.8 | -93.0 | -1.54 | -0.59 | -0.24 |
| 209 | C14 | Max | 596.5 | 300.6 | 51.7 | 1.54 | 0.78 | 0.13 |
| 209 | C14 | Min | -596.5 | -300.6 | -51.7 | -1.54 | -0.78 | -0.13 |
| 210 | C14 | Max | 596.8 | 300.6 | 51.7 | 1.55 | 0.78 | 0.13 |
| 210 | C14 | Min | -596.8 | -300.6 | -51.7 | -1.55 | -0.78 | -0.13 |
| 301 | C14 | Max | 532.7 | 282.1 | 118.7 | 1.38 | 0.73 | 0.31 |
| 301 | C14 | Min | -532.7 | -282.1 | -118.7 | -1.38 | -0.73 | -0.31 |
| 302 | C14 | Max | 511.0 | 284.5 | 114.3 | 1.32 | 0.74 | 0.30 |
| 302 | C14 | Min | -511.0 | -284.5 | -114.3 | -1.32 | -0.74 | -0.30 |
| 303 | C14 | Max | 478.4 | 333.5 | 95.1 | 1.24 | 0.86 | 0.25 |
| 303 | C14 | Min | -478.4 | -333.5 | -95.1 | -1.24 | -0.86 | -0.25 |
| 304 | C14 | Max | 454.9 | 333.8 | 93.0 | 1.18 | 0.86 | 0.24 |
| 304 | C14 | Min | -454.9 | -333.8 | -93.0 | -1.18 | -0.86 | -0.24 |
| 401 | C14 | Max | 540.1 | 283.6 | 118.7 | 1.40 | 0.73 | 0.31 |
| 401 | C14 | Min | -540.1 | -283.6 | -118.7 | -1.40 | -0.73 | -0.31 |
| 402 | C14 | Max | 512.9 | 286.3 | 114.3 | 1.33 | 0.74 | 0.30 |
| 402 | C14 | Min | -512.9 | -286.3 | -114.3 | -1.33 | -0.74 | -0.30 |
| 500 | C14 | Max | 19.6 | 19.1 | 76.0 | 0.05 | 0.05 | 0.20 |
| 500 | C14 | Min | -19.6 | -19.1 | -76.0 | -0.05 | -0.05 | -0.20 |

| CASE-14: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C14 | Max | 36.8 | 97.6 | 69.4 | 0.10 | 0.25 | 0.18 |
| 501 | C14 | Min | -36.8 | -97.6 | -69.4 | -0.10 | -0.25 | -0.18 |
| 600 | C14 | Max | 3.3 | 2.2 | 139.7 | 0.01 | 0.01 | 0.36 |
| 600 | C14 | Min | -3.3 | -2.2 | -139.7 | -0.01 | -0.01 | -0.36 |
| 601 | C14 | Max | 36.9 | 210.0 | 68.6 | 0.10 | 0.54 | 0.18 |
| 601 | C14 | Min | -36.9 | -210.0 | -68.6 | -0.10 | -0.54 | -0.18 |
| 701 | C14 | Max | 626.5 | 283.4 | 118.7 | 1.62 | 0.73 | 0.31 |
| 701 | C14 | Min | -626.5 | -283.4 | -118.7 | -1.62 | -0.73 | -0.31 |
| 702 | C14 | Max | 616.0 | 286.1 | 114.4 | 1.59 | 0.74 | 0.30 |
| 702 | C14 | Min | -616.0 | -286.1 | -114.4 | -1.59 | -0.74 | -0.30 |
| 703 | C14 | Max | 594.3 | 325.1 | 95.0 | 1.54 | 0.84 | 0.25 |
| 703 | C14 | Min | -594.3 | -325.1 | -95.0 | -1.54 | -0.84 | -0.25 |
| 704 | C14 | Max | 592.0 | 324.1 | 93.0 | 1.53 | 0.84 | 0.24 |
| 704 | C14 | Min | -592.0 | -324.1 | -93.0 | -1.53 | -0.84 | -0.24 |
| 801 | C14 | Max | 602.3 | 347.1 | 58.6 | 1.56 | 0.90 | 0.15 |
| 801 | C14 | Min | -602.3 | -347.1 | -58.6 | -1.56 | -0.90 | -0.15 |
| 802 | C14 | Max | 616.7 | 306.4 | 449.9 | 1.60 | 0.79 | 1.16 |
| 802 | C14 | Min | -616.7 | -306.4 | -449.9 | -1.60 | -0.79 | -1.16 |
| 803 | C14 | Max | 594.6 | 294.4 | 53.1 | 1.54 | 0.76 | 0.14 |
| 803 | C14 | Min | -594.6 | -294.4 | -53.1 | -1.54 | -0.76 | -0.14 |
| 804 | C14 | Max | 594.7 | 322.3 | 64.4 | 1.54 | 0.83 | 0.17 |
| 804 | C14 | Min | -594.7 | -322.3 | -64.4 | -1.54 | -0.83 | -0.17 |
| 805 | C14 | Max | 615.2 | 308.2 | 468.6 | 1.59 | 0.80 | 1.21 |
| 805 | C14 | Min | -615.2 | -308.2 | -468.6 | -1.59 | -0.80 | -1.21 |
| 806 | C14 | Max | 599.1 | 300.9 | 51.7 | 1.55 | 0.78 | 0.13 |
| 806 | C14 | Min | -599.1 | -300.9 | -51.7 | -1.55 | -0.78 | -0.13 |
| | **C14** | **MAX:** | **626.5** | **389.5** | **468.6** | **1.62** | **1.01** | **1.21** |

**Case-15**

| CASE-15: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 1 | C15 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 1 | C15 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 2 | C15 | Max | 522.6 | 240.8 | 48.6 | 1.35 | 0.62 | 0.13 |
| 2 | C15 | Min | -522.6 | -240.8 | -48.6 | -1.35 | -0.62 | -0.13 |
| 10 | C15 | Max | 522.6 | 313.3 | 48.5 | 1.35 | 0.81 | 0.13 |
| 10 | C15 | Min | -522.6 | -313.3 | -48.5 | -1.35 | -0.81 | -0.13 |
| 11 | C15 | Max | 522.6 | 276.1 | 48.6 | 1.35 | 0.72 | 0.13 |
| 11 | C15 | Min | -522.6 | -276.1 | -48.6 | -1.35 | -0.72 | -0.13 |
| 12 | C15 | Max | 522.6 | 273.1 | 48.6 | 1.35 | 0.71 | 0.13 |
| 12 | C15 | Min | -522.6 | -273.1 | -48.6 | -1.35 | -0.71 | -0.13 |
| 13 | C15 | Max | 522.6 | 271.7 | 48.6 | 1.35 | 0.70 | 0.13 |
| 13 | C15 | Min | -522.6 | -271.7 | -48.6 | -1.35 | -0.70 | -0.13 |
| 14 | C15 | Max | 624.6 | 300.4 | 48.6 | 1.62 | 0.78 | 0.13 |
| 14 | C15 | Min | -624.6 | -300.4 | -48.6 | -1.62 | -0.78 | -0.13 |
| 15 | C15 | Max | 602.4 | 279.3 | 48.6 | 1.56 | 0.72 | 0.13 |
| 15 | C15 | Min | -602.4 | -279.3 | -48.6 | -1.56 | -0.72 | -0.13 |
| 16 | C15 | Max | 605.2 | 259.7 | 48.6 | 1.57 | 0.67 | 0.13 |
| 16 | C15 | Min | -605.2 | -259.7 | -48.6 | -1.57 | -0.67 | -0.13 |
| 17 | C15 | Max | 609.3 | 265.7 | 48.6 | 1.58 | 0.69 | 0.13 |
| 17 | C15 | Min | -609.3 | -265.7 | -48.6 | -1.58 | -0.69 | -0.13 |
| 21 | C15 | Max | 561.2 | 291.3 | 48.5 | 1.45 | 0.75 | 0.13 |
| 21 | C15 | Min | -561.2 | -291.3 | -48.5 | -1.45 | -0.75 | -0.13 |
| 22 | C15 | Max | 564.1 | 282.0 | 48.6 | 1.46 | 0.73 | 0.13 |
| 22 | C15 | Min | -564.1 | -282.0 | -48.6 | -1.46 | -0.73 | -0.13 |
| 23 | C15 | Max | 569.0 | 273.7 | 48.6 | 1.47 | 0.71 | 0.13 |
| 23 | C15 | Min | -569.0 | -273.7 | -48.6 | -1.47 | -0.71 | -0.13 |
| 24 | C15 | Max | 565.7 | 273.7 | 48.5 | 1.46 | 0.71 | 0.13 |
| 24 | C15 | Min | -565.7 | -273.7 | -48.5 | -1.46 | -0.71 | -0.13 |
| 25 | C15 | Max | 623.8 | 294.2 | 48.7 | 1.62 | 0.76 | 0.13 |
| 25 | C15 | Min | -623.8 | -294.2 | -48.7 | -1.62 | -0.76 | -0.13 |
| 26 | C15 | Max | 602.1 | 285.1 | 48.6 | 1.56 | 0.74 | 0.13 |
| 26 | C15 | Min | -602.1 | -285.1 | -48.6 | -1.56 | -0.74 | -0.13 |
| 27 | C15 | Max | 605.8 | 262.1 | 48.6 | 1.57 | 0.68 | 0.13 |
| 27 | C15 | Min | -605.8 | -262.1 | -48.6 | -1.57 | -0.68 | -0.13 |
| 28 | C15 | Max | 609.6 | 262.1 | 48.5 | 1.58 | 0.68 | 0.13 |
| 28 | C15 | Min | -609.6 | -262.1 | -48.5 | -1.58 | -0.68 | -0.13 |
| 100 | C15 | Max | 592.5 | 282.4 | 56.1 | 1.53 | 0.73 | 0.15 |
| 100 | C15 | Min | -592.5 | -282.4 | -56.1 | -1.53 | -0.73 | -0.15 |
| 101 | C15 | Max | 592.8 | 283.3 | 56.1 | 1.53 | 0.73 | 0.15 |
| 101 | C15 | Min | -592.8 | -283.3 | -56.1 | -1.53 | -0.73 | -0.15 |
| 102 | C15 | Max | 597.5 | 240.7 | 97.3 | 1.55 | 0.62 | 0.25 |
| 102 | C15 | Min | -597.5 | -240.7 | -97.3 | -1.55 | -0.62 | -0.25 |
| 103 | C15 | Max | 598.7 | 346.8 | 137.0 | 1.55 | 0.90 | 0.35 |
| 103 | C15 | Min | -598.7 | -346.8 | -137.0 | -1.55 | -0.90 | -0.35 |
| 104 | C15 | Max | 595.6 | 266.7 | 148.6 | 1.54 | 0.69 | 0.38 |
| 104 | C15 | Min | -595.6 | -266.7 | -148.6 | -1.54 | -0.69 | -0.38 |

| CASE-15: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 105 | C15 | Max | 594.2 | 272.9 | 144.6 | 1.54 | 0.71 | 0.37 |
| 105 | C15 | Min | -594.2 | -272.9 | -144.6 | -1.54 | -0.71 | -0.37 |
| 106 | C15 | Max | 592.6 | 312.0 | 121.9 | 1.53 | 0.81 | 0.32 |
| 106 | C15 | Min | -592.6 | -312.0 | -121.9 | -1.53 | -0.81 | -0.32 |
| 107 | C15 | Max | 598.8 | 259.9 | 108.9 | 1.55 | 0.67 | 0.28 |
| 107 | C15 | Min | -598.8 | -259.9 | -108.9 | -1.55 | -0.67 | -0.28 |
| 108 | C15 | Max | 612.9 | 106.1 | 75.1 | 1.59 | 0.27 | 0.19 |
| 108 | C15 | Min | -612.9 | -106.1 | -75.1 | -1.59 | -0.27 | -0.19 |
| 109 | C15 | Max | 609.4 | 290.6 | 52.6 | 1.58 | 0.75 | 0.14 |
| 109 | C15 | Min | -609.4 | -290.6 | -52.6 | -1.58 | -0.75 | -0.14 |
| 110 | C15 | Max | 609.2 | 285.3 | 52.6 | 1.58 | 0.74 | 0.14 |
| 110 | C15 | Min | -609.2 | -285.3 | -52.6 | -1.58 | -0.74 | -0.14 |
| 200 | C15 | Max | 595.8 | 273.3 | 49.4 | 1.54 | 0.71 | 0.13 |
| 200 | C15 | Min | -595.8 | -273.3 | -49.4 | -1.54 | -0.71 | -0.13 |
| 201 | C15 | Max | 594.7 | 275.6 | 49.4 | 1.54 | 0.71 | 0.13 |
| 201 | C15 | Min | -594.7 | -275.6 | -49.4 | -1.54 | -0.71 | -0.13 |
| 202 | C15 | Max | 597.4 | 311.7 | 85.9 | 1.55 | 0.81 | 0.22 |
| 202 | C15 | Min | -597.4 | -311.7 | -85.9 | -1.55 | -0.81 | -0.22 |
| 203 | C15 | Max | 596.8 | 307.9 | 125.3 | 1.55 | 0.80 | 0.32 |
| 203 | C15 | Min | -596.8 | -307.9 | -125.3 | -1.55 | -0.80 | -0.32 |
| 204 | C15 | Max | 594.7 | 270.4 | 141.4 | 1.54 | 0.70 | 0.37 |
| 204 | C15 | Min | -594.7 | -270.4 | -141.4 | -1.54 | -0.70 | -0.37 |
| 205 | C15 | Max | 595.2 | 272.0 | 138.6 | 1.54 | 0.70 | 0.36 |
| 205 | C15 | Min | -595.2 | -272.0 | -138.6 | -1.54 | -0.70 | -0.36 |
| 206 | C15 | Max | 596.5 | 267.0 | 116.0 | 1.54 | 0.69 | 0.30 |
| 206 | C15 | Min | -596.5 | -267.0 | -116.0 | -1.54 | -0.69 | -0.30 |
| 207 | C15 | Max | 597.2 | 242.3 | 105.7 | 1.55 | 0.63 | 0.27 |
| 207 | C15 | Min | -597.2 | -242.3 | -105.7 | -1.55 | -0.63 | -0.27 |
| 208 | C15 | Max | 605.7 | 125.0 | 82.8 | 1.57 | 0.32 | 0.21 |
| 208 | C15 | Min | -605.7 | -125.0 | -82.8 | -1.57 | -0.32 | -0.21 |
| 209 | C15 | Max | 604.3 | 261.7 | 54.1 | 1.56 | 0.68 | 0.14 |
| 209 | C15 | Min | -604.3 | -261.7 | -54.1 | -1.56 | -0.68 | -0.14 |
| 210 | C15 | Max | 604.6 | 262.3 | 54.1 | 1.57 | 0.68 | 0.14 |
| 210 | C15 | Min | -604.6 | -262.3 | -54.1 | -1.57 | -0.68 | -0.14 |
| 301 | C15 | Max | 452.9 | 251.3 | 75.1 | 1.17 | 0.65 | 0.19 |
| 301 | C15 | Min | -452.9 | -251.3 | -75.1 | -1.17 | -0.65 | -0.19 |
| 302 | C15 | Max | 436.3 | 255.4 | 82.9 | 1.13 | 0.66 | 0.21 |
| 302 | C15 | Min | -436.3 | -255.4 | -82.9 | -1.13 | -0.66 | -0.21 |
| 303 | C15 | Max | 438.1 | 269.2 | 52.6 | 1.13 | 0.70 | 0.14 |
| 303 | C15 | Min | -438.1 | -269.2 | -52.6 | -1.13 | -0.70 | -0.14 |
| 304 | C15 | Max | 409.0 | 265.2 | 54.2 | 1.06 | 0.69 | 0.14 |
| 304 | C15 | Min | -409.0 | -265.2 | -54.2 | -1.06 | -0.69 | -0.14 |
| 401 | C15 | Max | 456.6 | 252.3 | 75.1 | 1.18 | 0.65 | 0.19 |
| 401 | C15 | Min | -456.6 | -252.3 | -75.1 | -1.18 | -0.65 | -0.19 |
| 402 | C15 | Max | 445.3 | 257.0 | 82.9 | 1.15 | 0.67 | 0.21 |
| 402 | C15 | Min | -445.3 | -257.0 | -82.9 | -1.15 | -0.67 | -0.21 |
| 500 | C15 | Max | 20.5 | 18.9 | 77.5 | 0.05 | 0.05 | 0.20 |
| 500 | C15 | Min | -20.5 | -18.9 | -77.5 | -0.05 | -0.05 | -0.20 |

| CASE-15: Joint Accelerations - Absolute | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Joint | Output | Step | U1 | U2 | U3 | U1 | U2 | U3 |
| Text | Case | Type | in/sec2 | in/sec2 | in/sec2 | g | g | g |
| 501 | C15 | Max | 36.9 | 75.5 | 67.3 | 0.10 | 0.20 | 0.17 |
| 501 | C15 | Min | -36.9 | -75.5 | -67.3 | -0.10 | -0.20 | -0.17 |
| 600 | C15 | Max | 3.3 | 2.1 | 83.1 | 0.01 | 0.01 | 0.22 |
| 600 | C15 | Min | -3.3 | -2.1 | -83.1 | -0.01 | -0.01 | -0.22 |
| 601 | C15 | Max | 36.9 | 188.9 | 74.9 | 0.10 | 0.49 | 0.19 |
| 601 | C15 | Min | -36.9 | -188.9 | -74.9 | -0.10 | -0.49 | -0.19 |
| 701 | C15 | Max | 629.5 | 252.2 | 75.1 | 1.63 | 0.65 | 0.19 |
| 701 | C15 | Min | -629.5 | -252.2 | -75.1 | -1.63 | -0.65 | -0.19 |
| 702 | C15 | Max | 620.4 | 256.9 | 82.9 | 1.61 | 0.67 | 0.21 |
| 702 | C15 | Min | -620.4 | -256.9 | -82.9 | -1.61 | -0.67 | -0.21 |
| 703 | C15 | Max | 609.7 | 268.9 | 52.6 | 1.58 | 0.70 | 0.14 |
| 703 | C15 | Min | -609.7 | -268.9 | -52.6 | -1.58 | -0.70 | -0.14 |
| 704 | C15 | Max | 605.6 | 264.4 | 54.2 | 1.57 | 0.68 | 0.14 |
| 704 | C15 | Min | -605.6 | -264.4 | -54.2 | -1.57 | -0.68 | -0.14 |
| 801 | C15 | Max | 592.0 | 280.4 | 56.1 | 1.53 | 0.73 | 0.15 |
| 801 | C15 | Min | -592.0 | -280.4 | -56.1 | -1.53 | -0.73 | -0.15 |
| 802 | C15 | Max | 601.1 | 266.3 | 111.8 | 1.56 | 0.69 | 0.29 |
| 802 | C15 | Min | -601.1 | -266.3 | -111.8 | -1.56 | -0.69 | -0.29 |
| 803 | C15 | Max | 598.2 | 268.2 | 49.4 | 1.55 | 0.69 | 0.13 |
| 803 | C15 | Min | -598.2 | -268.2 | -49.4 | -1.55 | -0.69 | -0.13 |
| 804 | C15 | Max | 609.1 | 274.2 | 52.6 | 1.58 | 0.71 | 0.14 |
| 804 | C15 | Min | -609.1 | -274.2 | -52.6 | -1.58 | -0.71 | -0.14 |
| 805 | C15 | Max | 606.7 | 266.6 | 116.0 | 1.57 | 0.69 | 0.30 |
| 805 | C15 | Min | -606.7 | -266.6 | -116.0 | -1.57 | -0.69 | -0.30 |
| 806 | C15 | Max | 605.4 | 263.3 | 54.1 | 1.57 | 0.68 | 0.14 |
| 806 | C15 | Min | -605.4 | -263.3 | -54.1 | -1.57 | -0.68 | -0.14 |
| | **C15** | **MAX:** | **629.5** | **346.8** | **148.6** | **1.63** | **0.90** | **0.38** |

## CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT G
## JOINT BASE REACTIONS

### Tabularized Selected Output

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**Total Pages = 61**

**Table Nomenclature**

F1 = North – South Direction Thrust Reactions (Transverse to Rail)

F2 = East-West Drive Wheel Reaction (In- Line with Rail)

F3 = Vertical Wheel Reactions

DL = $P_{db} + P_{dt}$

LL= $P_{lr}$

A1 = Time history set A1 joint reaction or member force (Table 4.1)

A2 = Time history set A2 joint reaction or member force (Table 4.1)

A3 = Time history set A3 joint reaction or member force (Table 4.1)

A4 = Time history set A4 joint reaction or member force (Table 4.1)

A5 = Time history set A5 joint reaction or member force (Table 4.1)

EQ = [Absolute Maximum (A1) + Absolute Maximum (A2) + Absolute Maximum (A3) + Absolute Maximum (A4) + Absolute Maximum (A5)] / 5

COii = DL + LL ± EQ where ii is the analysis case (trolley position & hoist load condition from Table 6.1)

**Case-01**

| CASE-01: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint No | Output Case | Case Type | Step Type | F1 Kip | F2 Kip | F3 Kip |
| 1 | A1 | NonModHist | Max | 40.332 | 8.012 | 23.969 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 26.707 |
| 11 | A1 | NonModHist | Max | 46.21 | 0 | 20.102 |
| 12 | A1 | NonModHist | Max | 34.201 | 0 | 17.862 |
| 13 | A1 | NonModHist | Max | 39.102 | 0 | 18.763 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 21.65 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 20.968 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 20.356 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **159.9** | **16.0** | **170.4** |
| 1 | A1 | NonModHist | Min | -34.823 | -8.011 | -24.821 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -27.307 |
| 11 | A1 | NonModHist | Min | -49.787 | 0 | -24.815 |
| 12 | A1 | NonModHist | Min | -34.216 | 0 | -21.356 |
| 13 | A1 | NonModHist | Min | -42.81 | 0 | -27.977 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -27.267 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -23.721 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -30.943 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-161.7** | **-16.0** | **-208.2** |
| 1 | A2 | NonModHist | Max | 40.601 | 8.01 | 20.795 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.01 | 24.437 |
| 11 | A2 | NonModHist | Max | 54.099 | 0 | 22.296 |
| 12 | A2 | NonModHist | Max | 45.031 | 0 | 20.272 |
| 13 | A2 | NonModHist | Max | 42.115 | 0 | 21.135 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 24.423 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 21.343 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 23.478 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **181.9** | **16.0** | **178.2** |
| 1 | A2 | NonModHist | Min | -34.247 | -8.01 | -18.949 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -22.601 |
| 11 | A2 | NonModHist | Min | -46.992 | 0 | -22.839 |
| 12 | A2 | NonModHist | Min | -38.614 | 0 | -18.356 |
| 13 | A2 | NonModHist | Min | -38.568 | 0 | -24.443 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -25.81 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -19.979 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -26.807 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-158.4** | **-16.0** | **-179.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 49.338 | 8.013 | 25.852 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.013 | 29.646 |
| 11 | A3 | NonModHist | Max | 43.852 | 0 | 29.026 |
| 12 | A3 | NonModHist | Max | 50.561 | 0 | 20.938 |
| 13 | A3 | NonModHist | Max | 32.607 | 0 | 22.752 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 29.399 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 23.319 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 26.253 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **176.4** | **16.0** | **207.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -49.431 | -8.013 | -22.751 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -25.781 |
| 11 | A3 | NonModHist | Min | -49.369 | 0 | -23.054 |
| 12 | A3 | NonModHist | Min | -48.995 | 0 | -21.128 |
| 13 | A3 | NonModHist | Min | -41.041 | 0 | -21.689 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -26.557 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -24.387 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -24.055 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-188.9** | **-16.0** | **-189.4** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 39.102 | 8.011 | 24.394 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.011 | 26.953 |
| 11 | A4 | NonModHist | Max | 69.142 | 0 | 25.309 |
| 12 | A4 | NonModHist | Max | 42.445 | 0 | 22.217 |
| 13 | A4 | NonModHist | Max | 55.788 | 0 | 23.349 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 27.235 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 24.192 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 26.659 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **206.5** | **16.0** | **200.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -33.654 | -8.011 | -20.422 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -25.559 |
| 11 | A4 | NonModHist | Min | -45.809 | 0 | -23.156 |
| 12 | A4 | NonModHist | Min | -35.463 | 0 | -21.297 |
| 13 | A4 | NonModHist | Min | -39.91 | 0 | -18.66 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -25.028 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -22.778 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -22.683 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-154.9** | **-16.0** | **-179.6** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 38.953 | 8.011 | 19.486 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 19.887 |
| 11 | A5 | NonModHist | Max | 40.891 | 0 | 25.212 |
| 12 | A5 | NonModHist | Max | 40.584 | 0 | 20.756 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 36.062 | 0 | 23.671 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 28.119 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 23.178 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 25.519 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **156.5** | **16.0** | **185.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -43.02 | -8.014 | -18.399 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -20.231 |
| 11 | A5 | NonModHist | Min | -44.751 | 0 | -23.084 |
| 12 | A5 | NonModHist | Min | -45.276 | 0 | -20.82 |
| 13 | A5 | NonModHist | Min | -37.944 | 0 | -21.669 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -24.508 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -22.051 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -24.009 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-171.0** | **-16.0** | **-174.8** |

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|---|---|---|---|---|---|---|
| 1 | C01 | Combination | Max | 42.47 | 8.009 | 78.409 |
| 2 | C01 | Combination | Max | 0.026 | 8.015 | 87.178 |
| 11 | C01 | Combination | Max | 53.518 | 0 | 82.232 |
| 12 | C01 | Combination | Max | 43.292 | 0 | 76.759 |
| 13 | C01 | Combination | Max | 44.092 | 0 | 78.583 |
| 15 | C01 | Combination | Max | 0 | 0 | 90.471 |
| 16 | C01 | Combination | Max | 0 | 0 | 84.964 |
| 17 | C01 | Combination | Max | 0 | 0 | 87.392 |
| 500 | C01 | Combination | Max | 0 | 0 | 0 |
| 600 | C01 | Combination | Max | 0 | 0 | 0 |
| | **C01** | **Max** | **SUM:** | **183.4** | **16.0** | **666.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C01 | Combination | Min | -42.525 | -8.015 | 32.269 |
| 2 | C01 | Combination | Min | -0.026 | -8.009 | 35.749 |
| 11 | C01 | Combination | Min | -53.341 | 0 | 31.351 |
| 12 | C01 | Combination | Min | -43.719 | 0 | 34.441 |
| 13 | C01 | Combination | Min | -43.788 | 0 | 29.706 |
| 15 | C01 | Combination | Min | 0 | 0 | 35.339 |
| 16 | C01 | Combination | Min | 0 | 0 | 38.236 |
| 17 | C01 | Combination | Min | 0 | 0 | 32.92 |
| 500 | C01 | Combination | Min | 0 | 0 | 0 |
| 600 | C01 | Combination | Min | 0 | 0 | 0 |
| | **C01** | **Min** | **SUM:** | **-183.4** | **-16.0** | **270.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.064 | -0.002402 | 26.393 |
| 2 | DL | LinStatic | | 0 | 0.002402 | 27.907 |
| 11 | DL | LinStatic | | 0.126 | 0 | 27.846 |
| 12 | DL | LinStatic | | -0.175 | 0 | 26.655 |
| 13 | DL | LinStatic | | 0.114 | 0 | 25.198 |
| 15 | DL | LinStatic | | 0 | 0 | 29.353 |
| 16 | DL | LinStatic | | 0 | 0 | 28.05 |
| 17 | DL | LinStatic | | 0 | 0 | 26.598 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 42.497 | 8.012 | 23.07 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 25.715 |
| 11 | EQ | Combination | Max | 53.429 | 0 | 25.44 |
| 12 | EQ | Combination | Max | 43.506 | 0 | 21.159 |
| 13 | EQ | Combination | Max | 43.94 | 0 | 24.438 |
| 15 | EQ | Combination | Max | 0 | 0 | 27.566 |
| 16 | EQ | Combination | Max | 0 | 0 | 23.364 |
| 17 | EQ | Combination | Max | 0 | 0 | 27.236 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **183.4** | **16.0** | **198.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -42.497 | -8.012 | -23.07 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -25.715 |
| 11 | EQ | Combination | Min | -53.429 | 0 | -25.44 |
| 12 | EQ | Combination | Min | -43.506 | 0 | -21.159 |
| 13 | EQ | Combination | Min | -43.94 | 0 | -24.438 |
| 15 | EQ | Combination | Min | 0 | 0 | -27.566 |
| 16 | EQ | Combination | Min | 0 | 0 | -23.364 |
| 17 | EQ | Combination | Min | 0 | 0 | -27.236 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-183.4** | **-16.0** | **-198.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.036 | -0.000296 | 28.946 |
| 2 | LL | LinStatic | | 0 | 0.0002958 | 33.557 |
| 11 | LL | LinStatic | | -0.037 | 0 | 28.946 |
| 12 | LL | LinStatic | | -0.038 | 0 | 28.945 |
| 13 | LL | LinStatic | | 0.039 | 0 | 28.947 |
| 15 | LL | LinStatic | | 0 | 0 | 33.552 |
| 16 | LL | LinStatic | | 0 | 0 | 33.55 |
| 17 | LL | LinStatic | | 0 | 0 | 33.558 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **250.0** |

**Case-02**

| CASE-02: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 50.322 | 8.012 | 16.034 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 25.307 |
| 11 | A1 | NonModHist | Max | 47.53 | 0 | 13.621 |
| 12 | A1 | NonModHist | Max | 35.542 | 0 | 12.394 |
| 13 | A1 | NonModHist | Max | 47.933 | 0 | 10.426 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 21.229 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 17.816 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 20.519 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **181.4** | **16.0** | **137.3** |
| 1 | A1 | NonModHist | Min | -49.003 | -8.011 | -13.184 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -20.833 |
| 11 | A1 | NonModHist | Min | -38.516 | 0 | -14.096 |
| 12 | A1 | NonModHist | Min | -39.608 | 0 | -12.066 |
| 13 | A1 | NonModHist | Min | -43.367 | 0 | -9.683 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -17.79 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -12.027 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -14.358 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-170.5** | **-16.0** | **-114.0** |
| 1 | A2 | NonModHist | Max | 42.197 | 8.01 | 14.941 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 24.846 |
| 11 | A2 | NonModHist | Max | 44.11 | 0 | 12.61 |
| 12 | A2 | NonModHist | Max | 39.904 | 0 | 10.516 |
| 13 | A2 | NonModHist | Max | 48.922 | 0 | 9.845 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 23.262 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 18.682 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 19.539 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **175.2** | **16.0** | **134.2** |
| 1 | A2 | NonModHist | Min | -44.391 | -8.01 | -20.512 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -22.419 |
| 11 | A2 | NonModHist | Min | -40.767 | 0 | -13.766 |
| 12 | A2 | NonModHist | Min | -34.151 | 0 | -11.734 |
| 13 | A2 | NonModHist | Min | -60.196 | 0 | -14.09 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -22.477 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -17.115 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -19.481 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-179.5** | **-16.0** | **-141.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 46.966 | 8.013 | 15.582 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 20.979 |
| 11 | A3 | NonModHist | Max | 34.42 | 0 | 11.744 |
| 12 | A3 | NonModHist | Max | 40.896 | 0 | 10.64 |
| 13 | A3 | NonModHist | Max | 39.591 | 0 | 9.973 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 23.575 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 15.556 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 17.755 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **161.9** | **16.0** | **125.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -60.567 | -8.013 | -13.292 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -23.178 |
| 11 | A3 | NonModHist | Min | -45.052 | 0 | -14.914 |
| 12 | A3 | NonModHist | Min | -51.18 | 0 | -12.797 |
| 13 | A3 | NonModHist | Min | -45.835 | 0 | -9.431 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -18.839 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -17.129 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -17.253 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-202.7** | **-16.0** | **-126.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 56.553 | 8.011 | 13.613 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 25.584 |
| 11 | A4 | NonModHist | Max | 50.342 | 0 | 13.416 |
| 12 | A4 | NonModHist | Max | 46.015 | 0 | 10.93 |
| 13 | A4 | NonModHist | Max | 50.462 | 0 | 9.138 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 24.51 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 20.362 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 22.216 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **203.4** | **16.0** | **139.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -51.828 | -8.011 | -16.397 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -24.971 |
| 11 | A4 | NonModHist | Min | -40.091 | 0 | -15.067 |
| 12 | A4 | NonModHist | Min | -36.359 | 0 | -12.635 |
| 13 | A4 | NonModHist | Min | -43.777 | 0 | -9.99 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -19.892 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -19.698 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -20.627 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-172.1** | **-16.0** | **-139.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 50.715 | 8.011 | 12.067 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 19.238 |
| 11 | A5 | NonModHist | Max | 46.492 | 0 | 11.623 |
| 12 | A5 | NonModHist | Max | 32.054 | 0 | 10.62 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 54.515 | 0 | 10.769 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 23.809 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 16.076 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 20.612 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **183.8** | **16.0** | **124.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -54.338 | -8.014 | -12.857 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -19.794 |
| 11 | A5 | NonModHist | Min | -54.241 | 0 | -12.547 |
| 12 | A5 | NonModHist | Min | -40.412 | 0 | -8.725 |
| 13 | A5 | NonModHist | Min | -58.197 | 0 | -7.858 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -20.035 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -19.355 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -15.452 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-207.2** | **-16.0** | **-116.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C02 | Combination | Max | 53.198 | 8.007 | 48.879 |
| 2 | C02 | Combination | Max | 0.026 | 8.017 | 107.966 |
| 11 | C02 | Combination | Max | 48.322 | 0 | 48.121 |
| 12 | C02 | Combination | Max | 43.297 | 0 | 45.125 |
| 13 | C02 | Combination | Max | 52.621 | 0 | 42.69 |
| 15 | C02 | Combination | Max | 0 | 0 | 108.906 |
| 16 | C02 | Combination | Max | 0 | 0 | 102.755 |
| 17 | C02 | Combination | Max | 0 | 0 | 102.813 |
| 500 | C02 | Combination | Max | 0 | 0 | 0 |
| 600 | C02 | Combination | Max | 0 | 0 | 0 |
| | **C02** | **Max** | **SUM:** | **197.5** | **16.0** | **607.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C02 | Combination | Min | -53.271 | -8.017 | 16.326 |
| 2 | C02 | Combination | Min | -0.026 | -8.007 | 60.483 |
| 11 | C02 | Combination | Min | -48.188 | 0 | 19.965 |
| 12 | C02 | Combination | Min | -43.551 | 0 | 21.053 |
| 13 | C02 | Combination | Min | -52.427 | 0 | 20.591 |
| 15 | C02 | Combination | Min | 0 | 0 | 62.352 |
| 16 | C02 | Combination | Min | 0 | 0 | 65.418 |
| 17 | C02 | Combination | Min | 0 | 0 | 62.556 |
| 500 | C02 | Combination | Min | 0 | 0 | 0 |
| 600 | C02 | Combination | Min | 0 | 0 | 0 |
| | **C02** | **Min** | **SUM:** | **-197.5** | **-16.0** | **328.7** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002336 | 19.277 |
| 2 | DL | LinStatic | | 0 | 0.002336 | 35.028 |
| 11 | DL | LinStatic | | 0.081 | 0 | 20.727 |
| 12 | DL | LinStatic | | -0.108 | 0 | 19.771 |
| 13 | DL | LinStatic | | 0.072 | 0 | 18.317 |
| 15 | DL | LinStatic | | 0 | 0 | 36.466 |
| 16 | DL | LinStatic | | 0 | 0 | 34.928 |
| 17 | DL | LinStatic | | 0 | 0 | 33.485 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 53.235 | 8.012 | 16.276 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 23.742 |
| 11 | EQ | Combination | Max | 48.255 | 0 | 14.078 |
| 12 | EQ | Combination | Max | 43.424 | 0 | 12.036 |
| 13 | EQ | Combination | Max | 52.524 | 0 | 11.05 |
| 15 | EQ | Combination | Max | 0 | 0 | 23.277 |
| 16 | EQ | Combination | Max | 0 | 0 | 18.668 |
| 17 | EQ | Combination | Max | 0 | 0 | 20.128 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **197.5** | **16.0** | **139.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -53.235 | -8.012 | -16.276 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -23.742 |
| 11 | EQ | Combination | Min | -48.255 | 0 | -14.078 |
| 12 | EQ | Combination | Min | -43.424 | 0 | -12.036 |
| 13 | EQ | Combination | Min | -52.524 | 0 | -11.05 |
| 15 | EQ | Combination | Min | 0 | 0 | -23.277 |
| 16 | EQ | Combination | Min | 0 | 0 | -18.668 |
| 17 | EQ | Combination | Min | 0 | 0 | -20.128 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-197.5** | **-16.0** | **-139.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.007978 | -0.002313 | 13.325 |
| 2 | LL | LinStatic | | 0 | 0.002313 | 49.196 |
| 11 | LL | LinStatic | | -0.014 | 0 | 13.316 |
| 12 | LL | LinStatic | | -0.019 | 0 | 13.318 |
| 13 | LL | LinStatic | | 0.025 | 0 | 13.324 |
| 15 | LL | LinStatic | | 0 | 0 | 49.163 |
| 16 | LL | LinStatic | | 0 | 0 | 49.159 |
| 17 | LL | LinStatic | | 0 | 0 | 49.199 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **250.0** |

**Case-03**

| CASE-03: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 47.858 | 8.012 | 9.192 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 19.006 |
| 11 | A1 | NonModHist | Max | 47.976 | 0 | 10.13 |
| 12 | A1 | NonModHist | Max | 37.337 | 0 | 7.449 |
| 13 | A1 | NonModHist | Max | 45.763 | 0 | 6.082 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 21.336 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 14.587 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 14.628 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **179.0** | **16.0** | **102.4** |
| 1 | A1 | NonModHist | Min | -47.046 | -8.011 | -9.527 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -23.132 |
| 11 | A1 | NonModHist | Min | -43.784 | 0 | -11.412 |
| 12 | A1 | NonModHist | Min | -40.122 | 0 | -7.874 |
| 13 | A1 | NonModHist | Min | -37.576 | 0 | -6.306 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -21.339 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -14.1 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -17.666 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-168.6** | **-16.0** | **-111.4** |
| 1 | A2 | NonModHist | Max | 43.924 | 8.01 | 11.251 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 23.8 |
| 11 | A2 | NonModHist | Max | 44.689 | 0 | 8.846 |
| 12 | A2 | NonModHist | Max | 36.986 | 0 | 6.985 |
| 13 | A2 | NonModHist | Max | 44.71 | 0 | 8.024 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 23.43 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 19.061 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 25.304 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **170.3** | **16.0** | **126.7** |
| 1 | A2 | NonModHist | Min | -39.451 | -8.01 | -11.41 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -25.499 |
| 11 | A2 | NonModHist | Min | -39.694 | 0 | -9.69 |
| 12 | A2 | NonModHist | Min | -35.334 | 0 | -6.595 |
| 13 | A2 | NonModHist | Min | -54.264 | 0 | -6.909 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -19.567 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -17.29 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -18.302 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-168.8** | **-16.0** | **-115.3** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 47.876 | 8.013 | 9.314 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 20.556 |
| 11 | A3 | NonModHist | Max | 36.51 | 0 | 10.945 |
| 12 | A3 | NonModHist | Max | 41.404 | 0 | 8.476 |
| 13 | A3 | NonModHist | Max | 43.203 | 0 | 5.94 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 21.731 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 18.033 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 15.457 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **169.0** | **16.0** | **110.5** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -56.67 | -8.013 | -8.995 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -21.154 |
| 11 | A3 | NonModHist | Min | -41.35 | 0 | -11.581 |
| 12 | A3 | NonModHist | Min | -49.545 | 0 | -9.055 |
| 13 | A3 | NonModHist | Min | -40.32 | 0 | -5.378 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -22.782 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -15.326 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -16.234 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-187.9** | **-16.0** | **-110.5** |

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|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 58.148 | 8.011 | 8.997 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 24.983 |
| 11 | A4 | NonModHist | Max | 46.476 | 0 | 12.325 |
| 12 | A4 | NonModHist | Max | 46.972 | 0 | 9.444 |
| 13 | A4 | NonModHist | Max | 42.616 | 0 | 6.309 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 18.321 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 17.72 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 21.157 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **194.2** | **16.0** | **119.3** |

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|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -51.227 | -8.011 | -9.1 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -23.439 |
| 11 | A4 | NonModHist | Min | -38.899 | 0 | -10.751 |
| 12 | A4 | NonModHist | Min | -36.314 | 0 | -7.546 |
| 13 | A4 | NonModHist | Min | -38.655 | 0 | -6.079 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -21.764 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -17.864 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -15.272 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-165.1** | **-16.0** | **-111.8** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 51.919 | 8.011 | 8.417 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 20.162 |
| 11 | A5 | NonModHist | Max | 49.402 | 0 | 12.746 |
| 12 | A5 | NonModHist | Max | 37.184 | 0 | 8.03 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 47.058 | 0 | 5.72 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 22.319 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 16.418 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 16.501 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **185.6** | **16.0** | **110.3** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -54.867 | -8.014 | -8.022 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -20.47 |
| 11 | A5 | NonModHist | Min | -54.231 | 0 | -15.116 |
| 12 | A5 | NonModHist | Min | -37.498 | 0 | -9.772 |
| 13 | A5 | NonModHist | Min | -54.843 | 0 | -5.423 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -21.112 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -16.568 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -15.489 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-201.5** | **-16.0** | **-112.0** |

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|---|---|---|---|---|---|---|
| 1 | C03 | Combination | Max | 52.252 | 8.006 | 29.563 |
| 2 | C03 | Combination | Max | 0.026 | 8.018 | 121.142 |
| 11 | C03 | Combination | Max | 47.012 | 0 | 33.454 |
| 12 | C03 | Combination | Max | 42.092 | 0 | 29.08 |
| 13 | C03 | Combination | Max | 48.245 | 0 | 25.482 |
| 15 | C03 | Combination | Max | 0 | 0 | 119.293 |
| 16 | C03 | Combination | Max | 0 | 0 | 112.667 |
| 17 | C03 | Combination | Max | 0 | 0 | 115.952 |
| 500 | C03 | Combination | Max | 0 | 0 | 0 |
| 600 | C03 | Combination | Max | 0 | 0 | 0 |
| | **C03** | **Max** | **SUM:** | **189.6** | **16.0** | **586.6** |

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|---|---|---|---|---|---|---|
| 1 | C03 | Combination | Min | -52.335 | -8.018 | 10.456 |
| 2 | C03 | Combination | Min | -0.026 | -8.006 | 75.047 |
| 11 | C03 | Combination | Min | -46.877 | 0 | 9.404 |
| 12 | C03 | Combination | Min | -42.357 | 0 | 11.828 |
| 13 | C03 | Combination | Min | -48.031 | 0 | 12.563 |
| 15 | C03 | Combination | Min | 0 | 0 | 74.64 |
| 16 | C03 | Combination | Min | 0 | 0 | 78.222 |
| 17 | C03 | Combination | Min | 0 | 0 | 77.207 |
| 500 | C03 | Combination | Min | 0 | 0 | 0 |
| 600 | C03 | Combination | Min | 0 | 0 | 0 |
| | **C03** | **Min** | **SUM:** | **-189.6** | **-16.0** | **349.4** |

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|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002066 | 15.389 |
| 2 | DL | LinStatic | | 0 | 0.002066 | 39.276 |
| 11 | DL | LinStatic | | 0.082 | 0 | 16.832 |
| 12 | DL | LinStatic | | -0.109 | 0 | 15.854 |
| 13 | DL | LinStatic | | 0.072 | 0 | 14.405 |
| 15 | DL | LinStatic | | 0 | 0 | 40.001 |
| 16 | DL | LinStatic | | 0 | 0 | 38.485 |

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|---|---|---|---|---|---|---|
| 17 | DL | LinStatic | | 0 | 0 | 37.757 |
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

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|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 52.294 | 8.012 | 9.554 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 23.048 |
| 11 | EQ | Combination | Max | 46.944 | 0 | 12.025 |
| 12 | EQ | Combination | Max | 42.225 | 0 | 8.626 |
| 13 | EQ | Combination | Max | 48.138 | 0 | 6.46 |
| 15 | EQ | Combination | Max | 0 | 0 | 22.327 |
| 16 | EQ | Combination | Max | 0 | 0 | 17.223 |
| 17 | EQ | Combination | Max | 0 | 0 | 19.372 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **189.6** | **16.0** | **118.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -52.294 | -8.012 | -9.554 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -23.048 |
| 11 | EQ | Combination | Min | -46.944 | 0 | -12.025 |
| 12 | EQ | Combination | Min | -42.225 | 0 | -8.626 |
| 13 | EQ | Combination | Min | -48.138 | 0 | -6.46 |
| 15 | EQ | Combination | Min | 0 | 0 | -22.327 |
| 16 | EQ | Combination | Min | 0 | 0 | -17.223 |
| 17 | EQ | Combination | Min | 0 | 0 | -19.372 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-189.6** | **-16.0** | **-118.6** |

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|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.003097 | -0.004347 | 4.62 |
| 2 | LL | LinStatic | | 0 | 0.004347 | 58.818 |
| 11 | LL | LinStatic | | -0.015 | 0 | 4.597 |
| 12 | LL | LinStatic | | -0.024 | 0 | 4.6 |
| 13 | LL | LinStatic | | 0.035 | 0 | 4.617 |
| 15 | LL | LinStatic | | 0 | 0 | 56.965 |
| 16 | LL | LinStatic | | 0 | 0 | 56.96 |
| 17 | LL | LinStatic | | 0 | 0 | 58.822 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **250.0** |

**Case-04**

| CASE-04: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint No | Output Case | Case Type | Step Type | F1 Kip | F2 Kip | F3 Kip |
| 1 | A1 | NonModHist | Max | 42.821 | 8.012 | 12.552 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 15.35 |
| 11 | A1 | NonModHist | Max | 48.173 | 0 | 11.032 |
| 12 | A1 | NonModHist | Max | 35.487 | 0 | 6.662 |
| 13 | A1 | NonModHist | Max | 43.062 | 0 | 8.903 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 12.137 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 8.228 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 10.11 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **169.6** | **16.0** | **85.0** |
| 1 | A1 | NonModHist | Min | -39.786 | -8.01 | -13.398 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.01 | -13.514 |
| 11 | A1 | NonModHist | Min | -47.217 | 0 | -11.877 |
| 12 | A1 | NonModHist | Min | -37.881 | 0 | -7.082 |
| 13 | A1 | NonModHist | Min | -36.312 | 0 | -9.911 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -11.297 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -7.909 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -10.515 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-161.2** | **-16.0** | **-85.5** |
| 1 | A2 | NonModHist | Max | 42.376 | 8.01 | 13.476 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.01 | 14.748 |
| 11 | A2 | NonModHist | Max | 49.49 | 0 | 11.868 |
| 12 | A2 | NonModHist | Max | 42.23 | 0 | 7.517 |
| 13 | A2 | NonModHist | Max | 42.129 | 0 | 10.086 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 11.364 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 7.192 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 11.664 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **176.2** | **16.0** | **87.9** |
| 1 | A2 | NonModHist | Min | -35.519 | -8.01 | -13.594 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -14.346 |
| 11 | A2 | NonModHist | Min | -41.393 | 0 | -12.546 |
| 12 | A2 | NonModHist | Min | -38.429 | 0 | -8.227 |
| 13 | A2 | NonModHist | Min | -36.609 | 0 | -9.605 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -11.314 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -7.487 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -10.566 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-152.0** | **-16.0** | **-87.7** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 51.789 | 8.013 | 13.168 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.013 | 14.329 |
| 11 | A3 | NonModHist | Max | 42.081 | 0 | 12.158 |
| 12 | A3 | NonModHist | Max | 55.886 | 0 | 8.594 |
| 13 | A3 | NonModHist | Max | 35.944 | 0 | 8.39 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 12.16 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 8.743 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 9.124 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **185.7** | **16.0** | **86.7** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -50.13 | -8.013 | -13.746 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.012 | -13.67 |
| 11 | A3 | NonModHist | Min | -48.293 | 0 | -12.059 |
| 12 | A3 | NonModHist | Min | -47.562 | 0 | -6.803 |
| 13 | A3 | NonModHist | Min | -42.326 | 0 | -10.658 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -13.215 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -6.659 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -11.083 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-188.3** | **-16.0** | **-87.9** |

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|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 38.506 | 8.011 | 13.657 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.011 | 14.468 |
| 11 | A4 | NonModHist | Max | 65.889 | 0 | 10.365 |
| 12 | A4 | NonModHist | Max | 43.462 | 0 | 7.922 |
| 13 | A4 | NonModHist | Max | 57.537 | 0 | 9.489 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 11.832 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 7.34 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 10.742 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **205.4** | **16.0** | **85.8** |

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|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -32.27 | -8.011 | -13.794 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -14.106 |
| 11 | A4 | NonModHist | Min | -43.96 | 0 | -11.324 |
| 12 | A4 | NonModHist | Min | -36.99 | 0 | -7.255 |
| 13 | A4 | NonModHist | Min | -38.726 | 0 | -10.538 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -12.627 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -7.748 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -11.747 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-152.0** | **-16.0** | **-89.1** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 44.006 | 8.011 | 12.306 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 12.654 |
| 11 | A5 | NonModHist | Max | 43.653 | 0 | 11.507 |
| 12 | A5 | NonModHist | Max | 38.216 | 0 | 8.397 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 35.762 | 0 | 7.976 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 13.077 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 8.108 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 8.704 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **161.7** | **16.0** | **82.7** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -48.443 | -8.014 | -14.026 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -13.29 |
| 11 | A5 | NonModHist | Min | -41.291 | 0 | -11.513 |
| 12 | A5 | NonModHist | Min | -47.41 | 0 | -8.271 |
| 13 | A5 | NonModHist | Min | -36.4 | 0 | -10.156 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -13.667 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -8.036 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -11.018 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-173.6** | **-16.0** | **-90.0** |

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|---|---|---|---|---|---|---|
| 1 | C04 | Combination | Max | 44.723 | 8.01 | 40.105 |
| 2 | C04 | Combination | Max | 0.026 | 8.014 | 42.344 |
| 11 | C04 | Combination | Max | 51.225 | 0 | 39.729 |
| 12 | C04 | Combination | Max | 45.198 | 0 | 34.7 |
| 13 | C04 | Combination | Max | 44.404 | 0 | 35.468 |
| 15 | C04 | Combination | Max | 0 | 0 | 41.955 |
| 16 | C04 | Combination | Max | 0 | 0 | 36.113 |
| 17 | C04 | Combination | Max | 0 | 0 | 37.803 |
| 500 | C04 | Combination | Max | 0 | 0 | 0 |
| 600 | C04 | Combination | Max | 0 | 0 | 0 |
| | **C04** | **Max** | **SUM:** | **185.6** | **16.0** | **308.2** |

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|---|---|---|---|---|---|---|
| 1 | C04 | Combination | Min | -44.851 | -8.014 | 12.681 |
| 2 | C04 | Combination | Min | -0.026 | -8.009 | 13.47 |
| 11 | C04 | Combination | Min | -50.974 | 0 | 15.962 |
| 12 | C04 | Combination | Min | -45.549 | 0 | 18.611 |
| 13 | C04 | Combination | Min | -44.177 | 0 | 14.928 |
| 15 | C04 | Combination | Min | 0 | 0 | 16.751 |
| 16 | C04 | Combination | Min | 0 | 0 | 19.987 |
| 17 | C04 | Combination | Min | 0 | 0 | 15.393 |
| 500 | C04 | Combination | Min | 0 | 0 | 0 |
| 600 | C04 | Combination | Min | 0 | 0 | 0 |
| | **C04** | **Min** | **SUM:** | **-185.6** | **-16.0** | **127.8** |

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|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.064 | -0.002402 | 26.393 |
| 2 | DL | LinStatic | | 0 | 0.002402 | 27.907 |
| 11 | DL | LinStatic | | 0.126 | 0 | 27.846 |
| 12 | DL | LinStatic | | -0.175 | 0 | 26.655 |
| 13 | DL | LinStatic | | 0.114 | 0 | 25.198 |
| 15 | DL | LinStatic | | 0 | 0 | 29.353 |
| 16 | DL | LinStatic | | 0 | 0 | 28.05 |

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|---|---|---|---|---|---|---|
| 17 | DL | LinStatic | | 0 | 0 | 26.598 |
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

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|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 44.787 | 8.012 | 13.712 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 14.437 |
| 11 | EQ | Combination | Max | 51.1 | 0 | 11.883 |
| 12 | EQ | Combination | Max | 45.374 | 0 | 8.044 |
| 13 | EQ | Combination | Max | 44.291 | 0 | 10.27 |
| 15 | EQ | Combination | Max | 0 | 0 | 12.602 |
| 16 | EQ | Combination | Max | 0 | 0 | 8.063 |
| 17 | EQ | Combination | Max | 0 | 0 | 11.205 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **185.6** | **16.0** | **90.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -44.787 | -8.012 | -13.712 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -14.437 |
| 11 | EQ | Combination | Min | -51.1 | 0 | -11.883 |
| 12 | EQ | Combination | Min | -45.374 | 0 | -8.044 |
| 13 | EQ | Combination | Min | -44.291 | 0 | -10.27 |
| 15 | EQ | Combination | Min | 0 | 0 | -12.602 |
| 16 | EQ | Combination | Min | 0 | 0 | -8.063 |
| 17 | EQ | Combination | Min | 0 | 0 | -11.205 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-185.6** | **-16.0** | **-90.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0 | 0 | 0 |
| 2 | LL | LinStatic | | 0 | 0 | 0 |
| 11 | LL | LinStatic | | 0 | 0 | 0 |
| 12 | LL | LinStatic | | 0 | 0 | 0 |
| 13 | LL | LinStatic | | 0 | 0 | 0 |
| 15 | LL | LinStatic | | 0 | 0 | 0 |
| 16 | LL | LinStatic | | 0 | 0 | 0 |
| 17 | LL | LinStatic | | 0 | 0 | 0 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **0.0** |

**Case-05**

| CASE-05: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 46.903 | 8.012 | 11.744 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 16.415 |
| 11 | A1 | NonModHist | Max | 45.748 | 0 | 14.797 |
| 12 | A1 | NonModHist | Max | 36.449 | 0 | 10.634 |
| 13 | A1 | NonModHist | Max | 41.265 | 0 | 9.171 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 15.373 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 8.136 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 8.562 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **170.4** | **16.0** | **94.8** |
| 1 | A1 | NonModHist | Min | -39.156 | -8.011 | -11.823 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -16.525 |
| 11 | A1 | NonModHist | Min | -40.149 | 0 | -12.417 |
| 12 | A1 | NonModHist | Min | -36.373 | 0 | -8.834 |
| 13 | A1 | NonModHist | Min | -46.036 | 0 | -7.006 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -11.293 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -7.801 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -9.537 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-161.7** | **-16.0** | **-85.2** |
| 1 | A2 | NonModHist | Max | 39.99 | 8.01 | 11.827 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 17.042 |
| 11 | A2 | NonModHist | Max | 46.312 | 0 | 14.106 |
| 12 | A2 | NonModHist | Max | 38.616 | 0 | 11.671 |
| 13 | A2 | NonModHist | Max | 51.372 | 0 | 8.195 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 15.12 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 8.108 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 11.514 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **176.3** | **16.0** | **97.6** |
| 1 | A2 | NonModHist | Min | -53.031 | -8.01 | -14.383 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -17.393 |
| 11 | A2 | NonModHist | Min | -40.504 | 0 | -13.543 |
| 12 | A2 | NonModHist | Min | -38.24 | 0 | -10.525 |
| 13 | A2 | NonModHist | Min | -52.343 | 0 | -10.727 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -12.18 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -9.548 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -10.873 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-184.1** | **-16.0** | **-99.2** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 48.581 | 8.013 | 12.958 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 15.943 |
| 11 | A3 | NonModHist | Max | 38.576 | 0 | 12.312 |
| 12 | A3 | NonModHist | Max | 44.889 | 0 | 10.135 |
| 13 | A3 | NonModHist | Max | 37.459 | 0 | 9.709 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 15.11 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 8.541 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 8.293 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **169.5** | **16.0** | **93.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -60.924 | -8.013 | -11.448 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -15.888 |
| 11 | A3 | NonModHist | Min | -46.98 | 0 | -12.929 |
| 12 | A3 | NonModHist | Min | -52.094 | 0 | -9.508 |
| 13 | A3 | NonModHist | Min | -41.851 | 0 | -6.419 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -13.506 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -8.019 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -9.786 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-201.9** | **-16.0** | **-87.5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 56.497 | 8.011 | 11.776 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 16.742 |
| 11 | A4 | NonModHist | Max | 51.472 | 0 | 12.373 |
| 12 | A4 | NonModHist | Max | 46.962 | 0 | 10.162 |
| 13 | A4 | NonModHist | Max | 42.649 | 0 | 7.719 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 11.167 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 8.147 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 8.04 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **197.6** | **16.0** | **86.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -47.721 | -8.011 | -14.247 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -16.295 |
| 11 | A4 | NonModHist | Min | -43.115 | 0 | -11.995 |
| 12 | A4 | NonModHist | Min | -36.549 | 0 | -9.447 |
| 13 | A4 | NonModHist | Min | -46.209 | 0 | -7.303 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -12.208 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -9.717 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -9.268 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-173.6** | **-16.0** | **-90.5** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 62.831 | 8.011 | 12.568 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 15.622 |
| 11 | A5 | NonModHist | Max | 42.989 | 0 | 14.008 |
| 12 | A5 | NonModHist | Max | 35.2 | 0 | 10.677 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 47.476 | 0 | 6.602 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 13.468 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 7.727 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 9.551 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **188.5** | **16.0** | **90.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -55.382 | -8.014 | -10.986 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -20.69 |
| 11 | A5 | NonModHist | Min | -56.115 | 0 | -12.215 |
| 12 | A5 | NonModHist | Min | -41.433 | 0 | -10.235 |
| 13 | A5 | NonModHist | Min | -60.137 | 0 | -8.304 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -12.655 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -8.246 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -10.5 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-213.1** | **-16.0** | **-93.8** |

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|---|---|---|---|---|---|---|
| 1 | C05 | Combination | Max | 55.993 | 8.01 | 32.473 |
| 2 | C05 | Combination | Max | 0.026 | 8.014 | 52.486 |
| 11 | C05 | Combination | Max | 49.406 | 0 | 34.37 |
| 12 | C05 | Combination | Max | 43.003 | 0 | 30.427 |
| 13 | C05 | Combination | Max | 49.387 | 0 | 27.443 |
| 15 | C05 | Combination | Max | 0 | 0 | 50.722 |
| 16 | C05 | Combination | Max | 0 | 0 | 43.766 |
| 17 | C05 | Combination | Max | 0 | 0 | 43.606 |
| 500 | C05 | Combination | Max | 0 | 0 | 0 |
| 600 | C05 | Combination | Max | 0 | 0 | 0 |
| | **C05** | **Max** | **SUM:** | **197.8** | **16.0** | **315.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C05 | Combination | Min | -56.082 | -8.014 | 6.082 |
| 2 | C05 | Combination | Min | -0.026 | -8.01 | 17.569 |
| 11 | C05 | Combination | Min | -49.244 | 0 | 7.084 |
| 12 | C05 | Combination | Min | -43.219 | 0 | 9.116 |
| 13 | C05 | Combination | Min | -49.243 | 0 | 9.191 |
| 15 | C05 | Combination | Min | 0 | 0 | 22.211 |
| 16 | C05 | Combination | Min | 0 | 0 | 26.09 |
| 17 | C05 | Combination | Min | 0 | 0 | 23.364 |
| 500 | C05 | Combination | Min | 0 | 0 | 0 |
| 600 | C05 | Combination | Min | 0 | 0 | 0 |
| | **C05** | **Min** | **SUM:** | **-197.8** | **-16.0** | **120.7** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002336 | 19.277 |
| 2 | DL | LinStatic | | 0 | 0.002336 | 35.028 |
| 11 | DL | LinStatic | | 0.081 | 0 | 20.727 |
| 12 | DL | LinStatic | | -0.108 | 0 | 19.771 |
| 13 | DL | LinStatic | | 0.072 | 0 | 18.317 |
| 15 | DL | LinStatic | | 0 | 0 | 36.466 |
| 16 | DL | LinStatic | | 0 | 0 | 34.928 |

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|---|---|---|---|---|---|---|
| 17 | DL | LinStatic | | 0 | 0 | 33.485 |
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

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|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 56.037 | 8.012 | 13.196 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 17.459 |
| 11 | EQ | Combination | Max | 49.325 | 0 | 13.643 |
| 12 | EQ | Combination | Max | 43.111 | 0 | 10.656 |
| 13 | EQ | Combination | Max | 49.315 | 0 | 9.126 |
| 15 | EQ | Combination | Max | 0 | 0 | 14.256 |
| 16 | EQ | Combination | Max | 0 | 0 | 8.838 |
| 17 | EQ | Combination | Max | 0 | 0 | 10.121 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **197.8** | **16.0** | **97.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -56.037 | -8.012 | -13.196 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -17.459 |
| 11 | EQ | Combination | Min | -49.325 | 0 | -13.643 |
| 12 | EQ | Combination | Min | -43.111 | 0 | -10.656 |
| 13 | EQ | Combination | Min | -49.315 | 0 | -9.126 |
| 15 | EQ | Combination | Min | 0 | 0 | -14.256 |
| 16 | EQ | Combination | Min | 0 | 0 | -8.838 |
| 17 | EQ | Combination | Min | 0 | 0 | -10.121 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-197.8** | **-16.0** | **-97.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0 | 0 | 0 |
| 2 | LL | LinStatic | | 0 | 0 | 0 |
| 11 | LL | LinStatic | | 0 | 0 | 0 |
| 12 | LL | LinStatic | | 0 | 0 | 0 |
| 13 | LL | LinStatic | | 0 | 0 | 0 |
| 15 | LL | LinStatic | | 0 | 0 | 0 |
| 16 | LL | LinStatic | | 0 | 0 | 0 |
| 17 | LL | LinStatic | | 0 | 0 | 0 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **0.0** |

**Case-06**

| CASE-06: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint No | Output Case | Case Type | Step Type | F1 Kip | F2 Kip | F3 Kip |
| 1 | A1 | NonModHist | Max | 45.585 | 8.012 | 9.117 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 14.086 |
| 11 | A1 | NonModHist | Max | 48.123 | 0 | 10.995 |
| 12 | A1 | NonModHist | Max | 38.671 | 0 | 7.105 |
| 13 | A1 | NonModHist | Max | 42.462 | 0 | 6.082 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 15.079 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 8.142 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 7.946 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **174.9** | **16.0** | **78.6** |
| 1 | A1 | NonModHist | Min | -45.417 | -8.011 | -8.399 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -14.48 |
| 11 | A1 | NonModHist | Min | -45.376 | 0 | -10.015 |
| 12 | A1 | NonModHist | Min | -34.955 | 0 | -6.828 |
| 13 | A1 | NonModHist | Min | -39.389 | 0 | -5.782 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -13.586 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -8.24 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -9.078 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-165.2** | **-16.0** | **-76.4** |
| 1 | A2 | NonModHist | Max | 39.385 | 8.01 | 10.181 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 13.95 |
| 11 | A2 | NonModHist | Max | 44.338 | 0 | 8.954 |
| 12 | A2 | NonModHist | Max | 36.771 | 0 | 5.608 |
| 13 | A2 | NonModHist | Max | 44.543 | 0 | 6.551 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 13.41 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 7.297 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 9.823 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **165.1** | **16.0** | **75.8** |
| 1 | A2 | NonModHist | Min | -47.14 | -8.01 | -9.462 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -14.548 |
| 11 | A2 | NonModHist | Min | -36.631 | 0 | -9.015 |
| 12 | A2 | NonModHist | Min | -31.505 | 0 | -6.516 |
| 13 | A2 | NonModHist | Min | -50.42 | 0 | -6.639 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -12.99 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -7.04 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -9.008 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-165.7** | **-16.0** | **-75.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 50.235 | 8.013 | 10.128 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 14.942 |
| 11 | A3 | NonModHist | Max | 41.033 | 0 | 10.027 |
| 12 | A3 | NonModHist | Max | 46.301 | 0 | 6.564 |
| 13 | A3 | NonModHist | Max | 35.105 | 0 | 6.953 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 16.532 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 9.072 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 7.768 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **172.7** | **16.0** | **82.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -57.321 | -8.013 | -9.348 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -14.638 |
| 11 | A3 | NonModHist | Min | -43.208 | 0 | -11.607 |
| 12 | A3 | NonModHist | Min | -49.188 | 0 | -7.093 |
| 13 | A3 | NonModHist | Min | -43.463 | 0 | -6.565 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -14.412 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -8.999 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -9.074 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-193.2** | **-16.0** | **-81.7** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 62.723 | 8.011 | 8.676 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 14.985 |
| 11 | A4 | NonModHist | Max | 49.453 | 0 | 8.717 |
| 12 | A4 | NonModHist | Max | 46.346 | 0 | 6.625 |
| 13 | A4 | NonModHist | Max | 36.959 | 0 | 5.779 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 12.075 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 8.097 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 8.579 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **195.5** | **16.0** | **73.5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -46.714 | -8.011 | -9.676 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -16.965 |
| 11 | A4 | NonModHist | Min | -40.815 | 0 | -9.464 |
| 12 | A4 | NonModHist | Min | -38.692 | 0 | -5.899 |
| 13 | A4 | NonModHist | Min | -39.217 | 0 | -6.181 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -14.771 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -8.871 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -8.669 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-165.5** | **-16.0** | **-80.5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 54.932 | 8.011 | 7.676 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 13.734 |
| 11 | A5 | NonModHist | Max | 37.841 | 0 | 10.111 |
| 12 | A5 | NonModHist | Max | 37.415 | 0 | 6.777 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 37.304 | 0 | 5.088 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 15.767 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 8.548 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 8.43 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **167.5** | **16.0** | **76.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -54.541 | -8.014 | -9.483 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -14.65 |
| 11 | A5 | NonModHist | Min | -52.094 | 0 | -8.911 |
| 12 | A5 | NonModHist | Min | -39.184 | 0 | -6.793 |
| 13 | A5 | NonModHist | Min | -60.111 | 0 | -5.262 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -15.071 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -10.825 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -8.469 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-206.0** | **-16.0** | **-79.5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C06 | Combination | Max | 53.496 | 8.01 | 25.106 |
| 2 | C06 | Combination | Max | 0.026 | 8.014 | 54.393 |
| 11 | C06 | Combination | Max | 47.525 | 0 | 27.07 |
| 12 | C06 | Combination | Max | 41.923 | 0 | 22.68 |
| 13 | C06 | Combination | Max | 47.206 | 0 | 20.629 |
| 15 | C06 | Combination | Max | 0 | 0 | 55.113 |
| 16 | C06 | Combination | Max | 0 | 0 | 47.346 |
| 17 | C06 | Combination | Max | 0 | 0 | 46.78 |
| 500 | C06 | Combination | Max | 0 | 0 | 0 |
| 600 | C06 | Combination | Max | 0 | 0 | 0 |
| | **C06** | **Max** | **SUM:** | **190.2** | **16.0** | **299.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C06 | Combination | Min | -53.585 | -8.014 | 5.673 |
| 2 | C06 | Combination | Min | -0.026 | -8.01 | 24.16 |
| 11 | C06 | Combination | Min | -47.361 | 0 | 6.593 |
| 12 | C06 | Combination | Min | -42.141 | 0 | 9.028 |
| 13 | C06 | Combination | Min | -47.063 | 0 | 8.182 |
| 15 | C06 | Combination | Min | 0 | 0 | 24.889 |
| 16 | C06 | Combination | Min | 0 | 0 | 29.624 |
| 17 | C06 | Combination | Min | 0 | 0 | 28.735 |
| 500 | C06 | Combination | Min | 0 | 0 | 0 |
| 600 | C06 | Combination | Min | 0 | 0 | 0 |
| | **C06** | **Min** | **SUM:** | **-190.2** | **-16.0** | **136.9** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002066 | 15.389 |
| 2 | DL | LinStatic | | 0 | 0.002066 | 39.276 |
| 11 | DL | LinStatic | | 0.082 | 0 | 16.832 |
| 12 | DL | LinStatic | | -0.109 | 0 | 15.854 |
| 13 | DL | LinStatic | | 0.072 | 0 | 14.405 |
| 15 | DL | LinStatic | | 0 | 0 | 40.001 |
| 16 | DL | LinStatic | | 0 | 0 | 38.485 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | DL | LinStatic | | 0 | 0 | 37.757 |
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 53.54 | 8.012 | 9.717 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 15.117 |
| 11 | EQ | Combination | Max | 47.443 | 0 | 10.238 |
| 12 | EQ | Combination | Max | 42.032 | 0 | 6.826 |
| 13 | EQ | Combination | Max | 47.135 | 0 | 6.223 |
| 15 | EQ | Combination | Max | 0 | 0 | 15.112 |
| 16 | EQ | Combination | Max | 0 | 0 | 8.861 |
| 17 | EQ | Combination | Max | 0 | 0 | 9.023 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **190.2** | **16.0** | **81.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -53.54 | -8.012 | -9.717 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -15.117 |
| 11 | EQ | Combination | Min | -47.443 | 0 | -10.238 |
| 12 | EQ | Combination | Min | -42.032 | 0 | -6.826 |
| 13 | EQ | Combination | Min | -47.135 | 0 | -6.223 |
| 15 | EQ | Combination | Min | 0 | 0 | -15.112 |
| 16 | EQ | Combination | Min | 0 | 0 | -8.861 |
| 17 | EQ | Combination | Min | 0 | 0 | -9.023 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-190.2** | **-16.0** | **-81.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0 | 0 | 0 |
| 2 | LL | LinStatic | | 0 | 0 | 0 |
| 11 | LL | LinStatic | | 0 | 0 | 0 |
| 12 | LL | LinStatic | | 0 | 0 | 0 |
| 13 | LL | LinStatic | | 0 | 0 | 0 |
| 15 | LL | LinStatic | | 0 | 0 | 0 |
| 16 | LL | LinStatic | | 0 | 0 | 0 |
| 17 | LL | LinStatic | | 0 | 0 | 0 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **0.0** |

**Case-07**

| CASE-07: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 44.673 | 8.012 | 34.2 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 37.406 |
| 11 | A1 | NonModHist | Max | 45.878 | 0 | 37.833 |
| 12 | A1 | NonModHist | Max | 37.461 | 0 | 31.238 |
| 13 | A1 | NonModHist | Max | 40.849 | 0 | 33.575 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 41.94 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 35.821 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 39.057 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **168.9** | **16.0** | **291.1** |
| 1 | A1 | NonModHist | Min | -41.067 | -8.011 | -36.316 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.01 | -39.669 |
| 11 | A1 | NonModHist | Min | -46.85 | 0 | -35.643 |
| 12 | A1 | NonModHist | Min | -37.26 | 0 | -36.22 |
| 13 | A1 | NonModHist | Min | -40.947 | 0 | -30.479 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -40.547 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -40.791 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -36.238 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-166.1** | **-16.0** | **-295.9** |
| 1 | A2 | NonModHist | Max | 40.921 | 8.01 | 32.091 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.01 | 36.169 |
| 11 | A2 | NonModHist | Max | 49.823 | 0 | 35.818 |
| 12 | A2 | NonModHist | Max | 46.472 | 0 | 29.094 |
| 13 | A2 | NonModHist | Max | 42.364 | 0 | 32.697 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 39.131 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 33.456 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 37.646 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **179.6** | **16.0** | **276.1** |
| 1 | A2 | NonModHist | Min | -33.725 | -8.01 | -31.889 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -34.799 |
| 11 | A2 | NonModHist | Min | -43.768 | 0 | -33.51 |
| 12 | A2 | NonModHist | Min | -37.554 | 0 | -34.313 |
| 13 | A2 | NonModHist | Min | -35.363 | 0 | -29.806 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -37.323 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -38.105 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -34.416 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-150.4** | **-16.0** | **-274.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 50.887 | 8.013 | 30.38 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.013 | 35.144 |
| 11 | A3 | NonModHist | Max | 43.31 | 0 | 36.119 |
| 12 | A3 | NonModHist | Max | 56.31 | 0 | 34.024 |
| 13 | A3 | NonModHist | Max | 36.901 | 0 | 30.277 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 39.269 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 38.023 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 36.017 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **187.4** | **16.0** | **279.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -49.795 | -8.013 | -27.403 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.012 | -31.192 |
| 11 | A3 | NonModHist | Min | -47.631 | 0 | -39.372 |
| 12 | A3 | NonModHist | Min | -49.145 | 0 | -32.145 |
| 13 | A3 | NonModHist | Min | -42.415 | 0 | -33.915 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -43.143 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -37.08 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -39.827 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-189.0** | **-16.0** | **-284.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 38.483 | 8.011 | 34.423 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.011 | 38.773 |
| 11 | A4 | NonModHist | Max | 64.078 | 0 | 36.775 |
| 12 | A4 | NonModHist | Max | 44.012 | 0 | 31.307 |
| 13 | A4 | NonModHist | Max | 56.49 | 0 | 31.728 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 39.632 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 35.683 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 37.894 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **203.1** | **16.0** | **286.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -32.893 | -8.011 | -37.647 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -42.56 |
| 11 | A4 | NonModHist | Min | -44.482 | 0 | -35.817 |
| 12 | A4 | NonModHist | Min | -35.562 | 0 | -33.501 |
| 13 | A4 | NonModHist | Min | -36.185 | 0 | -32.11 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -40.354 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -36.234 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -37.957 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-149.1** | **-16.0** | **-296.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 43.332 | 8.011 | 42.257 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 47.004 |
| 11 | A5 | NonModHist | Max | 44.682 | 0 | 33.767 |
| 12 | A5 | NonModHist | Max | 40.599 | 0 | 35.668 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 36.645 | 0 | 34.31 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 38.359 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 39.549 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 40.314 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **165.3** | **16.0** | **311.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -47.126 | -8.014 | -41.462 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -46.317 |
| 11 | A5 | NonModHist | Min | -47.317 | 0 | -32.564 |
| 12 | A5 | NonModHist | Min | -48.575 | 0 | -35.488 |
| 13 | A5 | NonModHist | Min | -39.427 | 0 | -36.34 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -38.037 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -40.407 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -40.969 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-182.5** | **-16.0** | **-311.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C07 | Combination | Max | 44.39 | 8.009 | 91.077 |
| 2 | C07 | Combination | Max | 0.026 | 8.015 | 101.573 |
| 11 | C07 | Combination | Max | 51.229 | 0 | 93.504 |
| 12 | C07 | Combination | Max | 46.353 | 0 | 90.345 |
| 13 | C07 | Combination | Max | 44.481 | 0 | 87.872 |
| 15 | C07 | Combination | Max | 0 | 0 | 103.491 |
| 16 | C07 | Combination | Max | 0 | 0 | 100.312 |
| 17 | C07 | Combination | Max | 0 | 0 | 99.248 |
| 500 | C07 | Combination | Max | 0 | 0 | 0 |
| 600 | C07 | Combination | Max | 0 | 0 | 0 |
| | **C07** | **Max** | **SUM:** | **186.5** | **16.0** | **767.4** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C07 | Combination | Min | -44.445 | -8.015 | 19.601 |
| 2 | C07 | Combination | Min | -0.026 | -8.009 | 21.354 |
| 11 | C07 | Combination | Min | -51.052 | 0 | 20.078 |
| 12 | C07 | Combination | Min | -46.779 | 0 | 20.855 |
| 13 | C07 | Combination | Min | -44.177 | 0 | 20.418 |
| 15 | C07 | Combination | Min | 0 | 0 | 22.32 |
| 16 | C07 | Combination | Min | 0 | 0 | 22.888 |
| 17 | C07 | Combination | Min | 0 | 0 | 21.065 |
| 500 | C07 | Combination | Min | 0 | 0 | 0 |
| 600 | C07 | Combination | Min | 0 | 0 | 0 |
| | **C07** | **Min** | **SUM:** | **-186.5** | **-16.0** | **168.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.064 | -0.002402 | 26.393 |
| 2 | DL | LinStatic | | 0 | 0.002402 | 27.907 |
| 11 | DL | LinStatic | | 0.126 | 0 | 27.846 |
| 12 | DL | LinStatic | | -0.175 | 0 | 26.655 |
| 13 | DL | LinStatic | | 0.114 | 0 | 25.198 |
| 15 | DL | LinStatic | | 0 | 0 | 29.353 |
| 16 | DL | LinStatic | | 0 | 0 | 28.05 |
| 17 | DL | LinStatic | | 0 | 0 | 26.598 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 44.418 | 8.012 | 35.738 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 40.109 |
| 11 | EQ | Combination | Max | 51.14 | 0 | 36.713 |
| 12 | EQ | Combination | Max | 46.566 | 0 | 34.745 |
| 13 | EQ | Combination | Max | 44.329 | 0 | 33.727 |
| 15 | EQ | Combination | Max | 0 | 0 | 40.586 |
| 16 | EQ | Combination | Max | 0 | 0 | 38.712 |
| 17 | EQ | Combination | Max | 0 | 0 | 39.091 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **186.5** | **16.0** | **299.4** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -44.418 | -8.012 | -35.738 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -40.109 |
| 11 | EQ | Combination | Min | -51.14 | 0 | -36.713 |
| 12 | EQ | Combination | Min | -46.566 | 0 | -34.745 |
| 13 | EQ | Combination | Min | -44.329 | 0 | -33.727 |
| 15 | EQ | Combination | Min | 0 | 0 | -40.586 |
| 16 | EQ | Combination | Min | 0 | 0 | -38.712 |
| 17 | EQ | Combination | Min | 0 | 0 | -39.091 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-186.5** | **-16.0** | **-299.4** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.036 | -0.000296 | 28.946 |
| 2 | LL | LinStatic | | 0 | 0.0002958 | 33.557 |
| 11 | LL | LinStatic | | -0.037 | 0 | 28.946 |
| 12 | LL | LinStatic | | -0.038 | 0 | 28.945 |
| 13 | LL | LinStatic | | 0.039 | 0 | 28.947 |
| 15 | LL | LinStatic | | 0 | 0 | 33.552 |
| 16 | LL | LinStatic | | 0 | 0 | 33.55 |
| 17 | LL | LinStatic | | 0 | 0 | 33.558 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **250.0** |

**Case-08**

| CASE-08: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 46.378 | 8.012 | 17.864 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 39.425 |
| 11 | A1 | NonModHist | Max | 44.77 | 0 | 20.418 |
| 12 | A1 | NonModHist | Max | 35.683 | 0 | 18.919 |
| 13 | A1 | NonModHist | Max | 47.422 | 0 | 15.794 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 48.904 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 41.089 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 41.405 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **174.3** | **16.0** | **243.8** |
| 1 | A1 | NonModHist | Min | -38.153 | -8.011 | -19.908 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -44.585 |
| 11 | A1 | NonModHist | Min | -42.89 | 0 | -21.745 |
| 12 | A1 | NonModHist | Min | -36.569 | 0 | -19.779 |
| 13 | A1 | NonModHist | Min | -50.32 | 0 | -17.684 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -46.301 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -41.777 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -40.658 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-168.0** | **-16.0** | **-252.4** |
| 1 | A2 | NonModHist | Max | 38.869 | 8.01 | 17.525 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 40.604 |
| 11 | A2 | NonModHist | Max | 46.862 | 0 | 22.324 |
| 12 | A2 | NonModHist | Max | 37.944 | 0 | 20.006 |
| 13 | A2 | NonModHist | Max | 49.494 | 0 | 12.616 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 40.403 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 38.071 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 35.293 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **173.2** | **16.0** | **226.8** |
| 1 | A2 | NonModHist | Min | -53.116 | -8.01 | -15.601 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -39.373 |
| 11 | A2 | NonModHist | Min | -41.862 | 0 | -17.972 |
| 12 | A2 | NonModHist | Min | -36.659 | 0 | -15.213 |
| 13 | A2 | NonModHist | Min | -54.852 | 0 | -13.481 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -44.668 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -37.443 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -40.153 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-186.5** | **-16.0** | **-223.9** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 49.158 | 8.013 | 17.863 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 46.473 |
| 11 | A3 | NonModHist | Max | 38.64 | 0 | 20.083 |
| 12 | A3 | NonModHist | Max | 44.93 | 0 | 16.979 |
| 13 | A3 | NonModHist | Max | 36.277 | 0 | 14.507 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 41.819 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 40.298 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 40.083 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **169.0** | **16.0** | **238.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -59.9 | -8.013 | -17.38 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -41.238 |
| 11 | A3 | NonModHist | Min | -44.388 | 0 | -19.808 |
| 12 | A3 | NonModHist | Min | -50.744 | 0 | -17.503 |
| 13 | A3 | NonModHist | Min | -44.238 | 0 | -14.503 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -48.205 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -42.635 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -40.871 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-199.3** | **-16.0** | **-242.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 55.914 | 8.011 | 17.555 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 47.367 |
| 11 | A4 | NonModHist | Max | 49.572 | 0 | 20.474 |
| 12 | A4 | NonModHist | Max | 44.112 | 0 | 16.717 |
| 13 | A4 | NonModHist | Max | 41.928 | 0 | 14.879 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 44.645 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 40.889 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 42.253 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **191.6** | **16.0** | **244.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -47.719 | -8.011 | -18.751 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -45.691 |
| 11 | A4 | NonModHist | Min | -43.519 | 0 | -19.222 |
| 12 | A4 | NonModHist | Min | -33.36 | 0 | -16.057 |
| 13 | A4 | NonModHist | Min | -46.558 | 0 | -15.137 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -42.71 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -39.214 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -41.327 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-171.2** | **-16.0** | **-238.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 58.498 | 8.011 | 16.699 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 34.658 |
| 11 | A5 | NonModHist | Max | 43.468 | 0 | 17.81 |
| 12 | A5 | NonModHist | Max | 33.007 | 0 | 16.132 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 49.657 | 0 | 17.62 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 49.738 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 40.838 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 42.673 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **184.7** | **16.0** | **236.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -53.373 | -8.014 | -18.208 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -41.458 |
| 11 | A5 | NonModHist | Min | -57.1 | 0 | -21.011 |
| 12 | A5 | NonModHist | Min | -41.29 | 0 | -17.289 |
| 13 | A5 | NonModHist | Min | -58.086 | 0 | -14.996 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -49.555 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -44.548 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -44.218 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-209.9** | **-16.0** | **-251.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C08 | Combination | Max | 54.725 | 8.007 | 51.054 |
| 2 | C08 | Combination | Max | 0.026 | 8.017 | 128.322 |
| 11 | C08 | Combination | Max | 48.605 | 0 | 55.171 |
| 12 | C08 | Combination | Max | 42.005 | 0 | 51.348 |
| 13 | C08 | Combination | Max | 50.908 | 0 | 47.327 |
| 15 | C08 | Combination | Max | 0 | 0 | 132.861 |
| 16 | C08 | Combination | Max | 0 | 0 | 125.671 |
| 17 | C08 | Combination | Max | 0 | 0 | 124.465 |
| 500 | C08 | Combination | Max | 0 | 0 | 0 |
| 600 | C08 | Combination | Max | 0 | 0 | 0 |
| | **C08** | **Max** | **SUM:** | **196.3** | **16.0** | **716.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C08 | Combination | Min | -54.798 | -8.017 | 14.152 |
| 2 | C08 | Combination | Min | -0.026 | -8.007 | 40.127 |
| 11 | C08 | Combination | Min | -48.472 | 0 | 12.916 |
| 12 | C08 | Combination | Min | -42.259 | 0 | 14.83 |
| 13 | C08 | Combination | Min | -50.714 | 0 | 15.955 |
| 15 | C08 | Combination | Min | 0 | 0 | 38.397 |
| 16 | C08 | Combination | Min | 0 | 0 | 42.503 |
| 17 | C08 | Combination | Min | 0 | 0 | 40.904 |
| 500 | C08 | Combination | Min | 0 | 0 | 0 |
| 600 | C08 | Combination | Min | 0 | 0 | 0 |
| | **C08** | **Min** | **SUM:** | **-196.3** | **-16.0** | **219.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002336 | 19.277 |
| 2 | DL | LinStatic | | 0 | 0.002336 | 35.028 |
| 11 | DL | LinStatic | | 0.081 | 0 | 20.727 |
| 12 | DL | LinStatic | | -0.108 | 0 | 19.771 |
| 13 | DL | LinStatic | | 0.072 | 0 | 18.317 |
| 15 | DL | LinStatic | | 0 | 0 | 36.466 |
| 16 | DL | LinStatic | | 0 | 0 | 34.928 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | DL | LinStatic | | 0 | 0 | 33.485 |
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 54.761 | 8.012 | 18.451 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 44.097 |
| 11 | EQ | Combination | Max | 48.538 | 0 | 21.127 |
| 12 | EQ | Combination | Max | 42.132 | 0 | 18.259 |
| 13 | EQ | Combination | Max | 50.811 | 0 | 15.686 |
| 15 | EQ | Combination | Max | 0 | 0 | 47.232 |
| 16 | EQ | Combination | Max | 0 | 0 | 41.584 |
| 17 | EQ | Combination | Max | 0 | 0 | 41.78 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **196.3** | **16.0** | **248.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -54.761 | -8.012 | -18.451 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -44.097 |
| 11 | EQ | Combination | Min | -48.538 | 0 | -21.127 |
| 12 | EQ | Combination | Min | -42.132 | 0 | -18.259 |
| 13 | EQ | Combination | Min | -50.811 | 0 | -15.686 |
| 15 | EQ | Combination | Min | 0 | 0 | -47.232 |
| 16 | EQ | Combination | Min | 0 | 0 | -41.584 |
| 17 | EQ | Combination | Min | 0 | 0 | -41.78 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-196.3** | **-16.0** | **-248.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.007978 | -0.002313 | 13.325 |
| 2 | LL | LinStatic | | 0 | 0.002313 | 49.196 |
| 11 | LL | LinStatic | | -0.014 | 0 | 13.316 |
| 12 | LL | LinStatic | | -0.019 | 0 | 13.318 |
| 13 | LL | LinStatic | | 0.025 | 0 | 13.324 |
| 15 | LL | LinStatic | | 0 | 0 | 49.163 |
| 16 | LL | LinStatic | | 0 | 0 | 49.159 |
| 17 | LL | LinStatic | | 0 | 0 | 49.199 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **250.0** |

**Case-09**

| CASE-09: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 43.114 | 8.012 | 9.182 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 38.517 |
| 11 | A1 | NonModHist | Max | 45.779 | 0 | 10.7 |
| 12 | A1 | NonModHist | Max | 39.32 | 0 | 7.001 |
| 13 | A1 | NonModHist | Max | 41.882 | 0 | 6.926 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 43.583 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 35.79 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 39.672 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **170.1** | **16.0** | **191.4** |
| 1 | A1 | NonModHist | Min | -44.782 | -8.011 | -9.15 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -39.942 |
| 11 | A1 | NonModHist | Min | -48.605 | 0 | -9.051 |
| 12 | A1 | NonModHist | Min | -35.302 | 0 | -7.765 |
| 13 | A1 | NonModHist | Min | -39.34 | 0 | -6.659 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -41.3 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -36.698 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -35.968 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-168.1** | **-16.0** | **-186.5** |
| 1 | A2 | NonModHist | Max | 39.432 | 8.01 | 10.263 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 36.923 |
| 11 | A2 | NonModHist | Max | 44.947 | 0 | 8.329 |
| 12 | A2 | NonModHist | Max | 38.038 | 0 | 6.22 |
| 13 | A2 | NonModHist | Max | 41.935 | 0 | 7.514 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 38.414 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 29.423 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 35.048 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **164.4** | **16.0** | **172.1** |
| 1 | A2 | NonModHist | Min | -47.398 | -8.01 | -9.87 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -31.435 |
| 11 | A2 | NonModHist | Min | -35.461 | 0 | -8.379 |
| 12 | A2 | NonModHist | Min | -30.878 | 0 | -6.525 |
| 13 | A2 | NonModHist | Min | -51.479 | 0 | -7.563 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -40.361 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -35.381 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -36.67 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-165.2** | **-16.0** | **-176.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 50.192 | 8.013 | 8.799 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 36.01 |
| 11 | A3 | NonModHist | Max | 39.857 | 0 | 11.096 |
| 12 | A3 | NonModHist | Max | 44.221 | 0 | 8.361 |
| 13 | A3 | NonModHist | Max | 34.904 | 0 | 6.15 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 37.929 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 32.511 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 33.929 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **169.2** | **16.0** | **174.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -57.204 | -8.013 | -9.037 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -42.225 |
| 11 | A3 | NonModHist | Min | -44.287 | 0 | -10.708 |
| 12 | A3 | NonModHist | Min | -48.668 | 0 | -6.89 |
| 13 | A3 | NonModHist | Min | -44.952 | 0 | -7.055 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -35.521 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -34.599 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -36.906 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-195.1** | **-16.0** | **-182.9** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 60.455 | 8.011 | 10.692 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.011 | 48.42 |
| 11 | A4 | NonModHist | Max | 49.523 | 0 | 9.28 |
| 12 | A4 | NonModHist | Max | 43.306 | 0 | 6.461 |
| 13 | A4 | NonModHist | Max | 37.757 | 0 | 8.031 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 40.531 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 39.261 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 41.634 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **191.1** | **16.0** | **204.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -48.495 | -8.011 | -10.031 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -46.165 |
| 11 | A4 | NonModHist | Min | -38.692 | 0 | -9.804 |
| 12 | A4 | NonModHist | Min | -36.721 | 0 | -7.095 |
| 13 | A4 | NonModHist | Min | -41.273 | 0 | -7.529 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -40.907 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -39.418 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -39.719 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-165.2** | **-16.0** | **-200.7** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 55.371 | 8.011 | 7.678 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 32.803 |
| 11 | A5 | NonModHist | Max | 38.293 | 0 | 9.603 |
| 12 | A5 | NonModHist | Max | 34.925 | 0 | 7.691 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 44.275 | 0 | 6.397 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 37.125 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 37.08 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 32.435 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **172.9** | **16.0** | **170.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -52.425 | -8.014 | -8.508 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -34.843 |
| 11 | A5 | NonModHist | Min | -51.288 | 0 | -8.848 |
| 12 | A5 | NonModHist | Min | -39.93 | 0 | -7.372 |
| 13 | A5 | NonModHist | Min | -60.154 | 0 | -6.467 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -42.233 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -37.377 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -38.886 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-203.8** | **-16.0** | **-184.5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C09 | Combination | Max | 53 | 8.006 | 29.546 |
| 2 | C09 | Combination | Max | 0.026 | 8.018 | 138.565 |
| 11 | C09 | Combination | Max | 47.797 | 0 | 31.345 |
| 12 | C09 | Combination | Max | 41.72 | 0 | 27.941 |
| 13 | C09 | Combination | Max | 48.055 | 0 | 26.231 |
| 15 | C09 | Combination | Max | 0 | 0 | 137.969 |
| 16 | C09 | Combination | Max | 0 | 0 | 132.139 |
| 17 | C09 | Combination | Max | 0 | 0 | 135.333 |
| 500 | C09 | Combination | Max | 0 | 0 | 0 |
| 600 | C09 | Combination | Max | 0 | 0 | 0 |
| | **C09** | **Max** | **SUM:** | **190.6** | **16.0** | **659.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C09 | Combination | Min | -53.084 | -8.018 | 10.473 |
| 2 | C09 | Combination | Min | -0.026 | -8.006 | 57.624 |
| 11 | C09 | Combination | Min | -47.662 | 0 | 11.513 |
| 12 | C09 | Combination | Min | -41.985 | 0 | 12.966 |
| 13 | C09 | Combination | Min | -47.841 | 0 | 11.814 |
| 15 | C09 | Combination | Min | 0 | 0 | 55.964 |
| 16 | C09 | Combination | Min | 0 | 0 | 58.75 |
| 17 | C09 | Combination | Min | 0 | 0 | 57.826 |
| 500 | C09 | Combination | Min | 0 | 0 | 0 |
| 600 | C09 | Combination | Min | 0 | 0 | 0 |
| | **C09** | **Min** | **SUM:** | **-190.6** | **-16.0** | **276.9** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002066 | 15.389 |
| 2 | DL | LinStatic | | 0 | 0.002066 | 39.276 |
| 11 | DL | LinStatic | | 0.082 | 0 | 16.832 |
| 12 | DL | LinStatic | | -0.109 | 0 | 15.854 |
| 13 | DL | LinStatic | | 0.072 | 0 | 14.405 |
| 15 | DL | LinStatic | | 0 | 0 | 40.001 |
| 16 | DL | LinStatic | | 0 | 0 | 38.485 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | DL | LinStatic | | 0 | 0 | 37.757 |
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 53.042 | 8.012 | 9.537 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 40.471 |
| 11 | EQ | Combination | Max | 47.73 | 0 | 9.916 |
| 12 | EQ | Combination | Max | 41.853 | 0 | 7.487 |
| 13 | EQ | Combination | Max | 47.948 | 0 | 7.208 |
| 15 | EQ | Combination | Max | 0 | 0 | 41.003 |
| 16 | EQ | Combination | Max | 0 | 0 | 36.695 |
| 17 | EQ | Combination | Max | 0 | 0 | 38.754 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **190.6** | **16.0** | **191.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -53.042 | -8.012 | -9.537 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -40.471 |
| 11 | EQ | Combination | Min | -47.73 | 0 | -9.916 |
| 12 | EQ | Combination | Min | -41.853 | 0 | -7.487 |
| 13 | EQ | Combination | Min | -47.948 | 0 | -7.208 |
| 15 | EQ | Combination | Min | 0 | 0 | -41.003 |
| 16 | EQ | Combination | Min | 0 | 0 | -36.695 |
| 17 | EQ | Combination | Min | 0 | 0 | -38.754 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-190.6** | **-16.0** | **-191.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.003097 | -0.004347 | 4.62 |
| 2 | LL | LinStatic | | 0 | 0.004347 | 58.818 |
| 11 | LL | LinStatic | | -0.015 | 0 | 4.597 |
| 12 | LL | LinStatic | | -0.024 | 0 | 4.6 |
| 13 | LL | LinStatic | | 0.035 | 0 | 4.617 |
| 15 | LL | LinStatic | | 0 | 0 | 56.965 |
| 16 | LL | LinStatic | | 0 | 0 | 56.96 |
| 17 | LL | LinStatic | | 0 | 0 | 58.822 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **250.0** |

**Case-10**

| CASE-10: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 39.726 | 8.012 | 11.125 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 13.5 |
| 11 | A1 | NonModHist | Max | 44.436 | 0 | 10.854 |
| 12 | A1 | NonModHist | Max | 35.871 | 0 | 7.036 |
| 13 | A1 | NonModHist | Max | 42.201 | 0 | 8.181 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 11.703 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 7.883 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 11.386 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **162.3** | **16.0** | **81.7** |
| 1 | A1 | NonModHist | Min | -38.799 | -8.01 | -11.252 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.01 | -13.374 |
| 11 | A1 | NonModHist | Min | -48.685 | 0 | -11.619 |
| 12 | A1 | NonModHist | Min | -37.326 | 0 | -8.493 |
| 13 | A1 | NonModHist | Min | -41.749 | 0 | -9.153 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -12.605 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -9.554 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -9.934 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-166.6** | **-16.0** | **-86.0** |
| 1 | A2 | NonModHist | Max | 40.462 | 8.01 | 12.536 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.01 | 13.216 |
| 11 | A2 | NonModHist | Max | 49.623 | 0 | 12.417 |
| 12 | A2 | NonModHist | Max | 43.718 | 0 | 7.731 |
| 13 | A2 | NonModHist | Max | 42.993 | 0 | 8.713 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 11.241 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 8.394 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 9.632 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **176.8** | **16.0** | **83.9** |
| 1 | A2 | NonModHist | Min | -34.816 | -8.01 | -13.106 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -15.201 |
| 11 | A2 | NonModHist | Min | -44.498 | 0 | -12.013 |
| 12 | A2 | NonModHist | Min | -38.756 | 0 | -8.012 |
| 13 | A2 | NonModHist | Min | -36.874 | 0 | -9.138 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -12.284 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -9.705 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -10.006 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-155.0** | **-16.0** | **-89.5** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 52.475 | 8.013 | 12.676 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.013 | 12.051 |
| 11 | A3 | NonModHist | Max | 44.654 | 0 | 12.114 |
| 12 | A3 | NonModHist | Max | 58.169 | 0 | 8.892 |
| 13 | A3 | NonModHist | Max | 34.755 | 0 | 8.389 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 11.831 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 9.42 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 9.081 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **190.1** | **16.0** | **84.5** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -49.285 | -8.013 | -11.026 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -14.057 |
| 11 | A3 | NonModHist | Min | -46.079 | 0 | -11.269 |
| 12 | A3 | NonModHist | Min | -48.99 | 0 | -8.056 |
| 13 | A3 | NonModHist | Min | -41.217 | 0 | -9.429 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -13.376 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -8.628 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -9.838 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-185.6** | **-16.0** | **-85.7** |

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|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 38.453 | 8.011 | 11.799 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.011 | 13.403 |
| 11 | A4 | NonModHist | Max | 64.496 | 0 | 10.358 |
| 12 | A4 | NonModHist | Max | 41.465 | 0 | 7.821 |
| 13 | A4 | NonModHist | Max | 56.167 | 0 | 8.323 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 10.42 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 8.783 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 9.766 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **200.6** | **16.0** | **80.7** |

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|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -32.676 | -8.011 | -14.297 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -14.653 |
| 11 | A4 | NonModHist | Min | -44.897 | 0 | -11.009 |
| 12 | A4 | NonModHist | Min | -36.534 | 0 | -9.778 |
| 13 | A4 | NonModHist | Min | -37.072 | 0 | -8.105 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -12.358 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -10.886 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -9.884 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-151.2** | **-16.0** | **-91.0** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 43.318 | 8.011 | 10.908 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 11.816 |
| 11 | A5 | NonModHist | Max | 43.679 | 0 | 12.092 |
| 12 | A5 | NonModHist | Max | 39.073 | 0 | 10.366 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 35.48 | 0 | 7.509 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 13.085 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 10.531 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 8.938 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **161.6** | **16.0** | **85.2** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -44.577 | -8.014 | -11.514 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -13.5 |
| 11 | A5 | NonModHist | Min | -46.021 | 0 | -12.003 |
| 12 | A5 | NonModHist | Min | -44.593 | 0 | -8.666 |
| 13 | A5 | NonModHist | Min | -38.731 | 0 | -7.656 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -11.404 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -8.781 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -9.006 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-173.9** | **-16.0** | **-82.5** |

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|---|---|---|---|---|---|---|
| 1 | C10 | Combination | Max | 43.089 | 8.01 | 42.845 |
| 2 | C10 | Combination | Max | 0.026 | 8.014 | 45.707 |
| 11 | C10 | Combination | Max | 51.092 | 0 | 43.579 |
| 12 | C10 | Combination | Max | 44.864 | 0 | 39.646 |
| 13 | C10 | Combination | Max | 44.39 | 0 | 37.821 |
| 15 | C10 | Combination | Max | 0 | 0 | 45.712 |
| 16 | C10 | Combination | Max | 0 | 0 | 41.686 |
| 17 | C10 | Combination | Max | 0 | 0 | 40.24 |
| 500 | C10 | Combination | Max | 0 | 0 | 0 |
| 600 | C10 | Combination | Max | 0 | 0 | 0 |
| | **C10** | **Max** | **SUM:** | **183.5** | **16.0** | **337.2** |

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|---|---|---|---|---|---|---|
| 1 | C10 | Combination | Min | -43.188 | -8.014 | 17.706 |
| 2 | C10 | Combination | Min | -0.026 | -8.01 | 17.342 |
| 11 | C10 | Combination | Min | -50.87 | 0 | 19.878 |
| 12 | C10 | Combination | Min | -45.244 | 0 | 21.43 |
| 13 | C10 | Combination | Min | -44.134 | 0 | 20.341 |
| 15 | C10 | Combination | Min | 0 | 0 | 20.229 |
| 16 | C10 | Combination | Min | 0 | 0 | 21.647 |
| 17 | C10 | Combination | Min | 0 | 0 | 20.192 |
| 500 | C10 | Combination | Min | 0 | 0 | 0 |
| 600 | C10 | Combination | Min | 0 | 0 | 0 |
| | **C10** | **Min** | **SUM:** | **-183.5** | **-16.0** | **158.8** |

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|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.064 | -0.002402 | 26.393 |
| 2 | DL | LinStatic | | 0 | 0.002402 | 27.907 |
| 11 | DL | LinStatic | | 0.126 | 0 | 27.846 |
| 12 | DL | LinStatic | | -0.175 | 0 | 26.655 |
| 13 | DL | LinStatic | | 0.114 | 0 | 25.198 |
| 15 | DL | LinStatic | | 0 | 0 | 29.353 |
| 16 | DL | LinStatic | | 0 | 0 | 28.05 |

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|---|---|---|---|---|---|---|
| 17 | DL | LinStatic | | 0 | 0 | 26.598 |
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

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|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 43.138 | 8.012 | 12.569 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 14.182 |
| 11 | EQ | Combination | Max | 50.981 | 0 | 11.85 |
| 12 | EQ | Combination | Max | 45.054 | 0 | 9.108 |
| 13 | EQ | Combination | Max | 44.262 | 0 | 8.74 |
| 15 | EQ | Combination | Max | 0 | 0 | 12.742 |
| 16 | EQ | Combination | Max | 0 | 0 | 10.019 |
| 17 | EQ | Combination | Max | 0 | 0 | 10.024 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **183.5** | **16.0** | **89.2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -43.138 | -8.012 | -12.569 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -14.182 |
| 11 | EQ | Combination | Min | -50.981 | 0 | -11.85 |
| 12 | EQ | Combination | Min | -45.054 | 0 | -9.108 |
| 13 | EQ | Combination | Min | -44.262 | 0 | -8.74 |
| 15 | EQ | Combination | Min | 0 | 0 | -12.742 |
| 16 | EQ | Combination | Min | 0 | 0 | -10.019 |
| 17 | EQ | Combination | Min | 0 | 0 | -10.024 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-183.5** | **-16.0** | **-89.2** |

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|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.015 | 1.864E-05 | 3.882 |
| 2 | LL | LinStatic | | 0 | -1.86E-05 | 3.618 |
| 11 | LL | LinStatic | | -0.015 | 0 | 3.883 |
| 12 | LL | LinStatic | | -0.015 | 0 | 3.883 |
| 13 | LL | LinStatic | | 0.015 | 0 | 3.883 |
| 15 | LL | LinStatic | | 0 | 0 | 3.617 |
| 16 | LL | LinStatic | | 0 | 0 | 3.617 |
| 17 | LL | LinStatic | | 0 | 0 | 3.618 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **30.0** |

**Case-11**

| CASE-11: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 44.718 | 8.012 | 12.164 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 15.265 |
| 11 | A1 | NonModHist | Max | 45.866 | 0 | 13.91 |
| 12 | A1 | NonModHist | Max | 36.52 | 0 | 11.689 |
| 13 | A1 | NonModHist | Max | 44.519 | 0 | 8.971 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 11.926 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 7.734 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 9.341 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **171.6** | **16.0** | **91.0** |
| 1 | A1 | NonModHist | Min | -39.297 | -8.011 | -15.763 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -15.552 |
| 11 | A1 | NonModHist | Min | -41.091 | 0 | -13.857 |
| 12 | A1 | NonModHist | Min | -37.734 | 0 | -11.274 |
| 13 | A1 | NonModHist | Min | -49.004 | 0 | -9.793 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -11.204 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -7.939 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -9.551 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-167.2** | **-16.0** | **-94.9** |
| 1 | A2 | NonModHist | Max | 39.942 | 8.01 | 16.875 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 15.402 |
| 11 | A2 | NonModHist | Max | 46.255 | 0 | 11.505 |
| 12 | A2 | NonModHist | Max | 39.122 | 0 | 9.976 |
| 13 | A2 | NonModHist | Max | 51.1 | 0 | 10.079 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 13.815 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 8.441 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 12.44 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **176.4** | **16.0** | **98.5** |
| 1 | A2 | NonModHist | Min | -54.133 | -8.01 | -14.927 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -15.666 |
| 11 | A2 | NonModHist | Min | -39.914 | 0 | -12.197 |
| 12 | A2 | NonModHist | Min | -37.92 | 0 | -9.806 |
| 13 | A2 | NonModHist | Min | -53.627 | 0 | -10.423 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -12.876 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -8.203 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -11.455 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-185.6** | **-16.0** | **-95.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 49.93 | 8.013 | 13.885 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 14.877 |
| 11 | A3 | NonModHist | Max | 39.055 | 0 | 11.772 |
| 12 | A3 | NonModHist | Max | 47.444 | 0 | 9.425 |
| 13 | A3 | NonModHist | Max | 37.058 | 0 | 9.401 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 13.552 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 7.997 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 8.947 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **173.5** | **16.0** | **89.9** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -61.808 | -8.013 | -12.7 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -15.879 |
| 11 | A3 | NonModHist | Min | -44.866 | 0 | -11.651 |
| 12 | A3 | NonModHist | Min | -51.769 | 0 | -9.551 |
| 13 | A3 | NonModHist | Min | -42.114 | 0 | -8.706 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -13.081 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -9.417 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -9.108 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-200.6** | **-16.0** | **-90.1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 54.89 | 8.011 | 11.909 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 17.377 |
| 11 | A4 | NonModHist | Max | 49.553 | 0 | 14.134 |
| 12 | A4 | NonModHist | Max | 44.644 | 0 | 11.309 |
| 13 | A4 | NonModHist | Max | 43.581 | 0 | 8.156 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 12.093 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 7.836 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 8.68 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **192.7** | **16.0** | **91.5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -47.559 | -8.011 | -12.947 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -17.864 |
| 11 | A4 | NonModHist | Min | -41.86 | 0 | -12.583 |
| 12 | A4 | NonModHist | Min | -35.705 | 0 | -11.804 |
| 13 | A4 | NonModHist | Min | -44.149 | 0 | -8.355 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -13.533 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -10.378 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -9.181 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-169.3** | **-16.0** | **-96.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 59.304 | 8.011 | 10.444 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 14.729 |
| 11 | A5 | NonModHist | Max | 42.275 | 0 | 13.859 |
| 12 | A5 | NonModHist | Max | 34.253 | 0 | 10.898 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 48.352 | 0 | 7.527 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 13.445 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 8.084 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 9.698 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **184.2** | **16.0** | **88.7** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -54.213 | -8.014 | -11.374 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -23.245 |
| 11 | A5 | NonModHist | Min | -56.137 | 0 | -13.215 |
| 12 | A5 | NonModHist | Min | -42.204 | 0 | -11.069 |
| 13 | A5 | NonModHist | Min | -58.054 | 0 | -8.835 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -12.73 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -9.707 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -7.786 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-210.6** | **-16.0** | **-98.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C11 | Combination | Max | 54.935 | 8.009 | 35.454 |
| 2 | C11 | Combination | Max | 0.026 | 8.015 | 58.16 |
| 11 | C11 | Combination | Max | 48.607 | 0 | 35.909 |
| 12 | C11 | Combination | Max | 42.976 | 0 | 32.597 |
| 13 | C11 | Combination | Max | 49.472 | 0 | 29.686 |
| 15 | C11 | Combination | Max | 0 | 0 | 55.214 |
| 16 | C11 | Combination | Max | 0 | 0 | 49.598 |
| 17 | C11 | Combination | Max | 0 | 0 | 48.972 |
| 500 | C11 | Combination | Max | 0 | 0 | 0 |
| 600 | C11 | Combination | Max | 0 | 0 | 0 |
| | **C11** | **Max** | **SUM:** | **196.0** | **16.0** | **345.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C11 | Combination | Min | -55.006 | -8.015 | 7.116 |
| 2 | C11 | Combination | Min | -0.026 | -8.009 | 22.878 |
| 11 | C11 | Combination | Min | -48.464 | 0 | 9.56 |
| 12 | C11 | Combination | Min | -43.213 | 0 | 10.961 |
| 13 | C11 | Combination | Min | -49.307 | 0 | 10.963 |
| 15 | C11 | Combination | Min | 0 | 0 | 28.706 |
| 16 | C11 | Combination | Min | 0 | 0 | 31.245 |
| 17 | C11 | Combination | Min | 0 | 0 | 28.981 |
| 500 | C11 | Combination | Min | 0 | 0 | 0 |
| 600 | C11 | Combination | Min | 0 | 0 | 0 |
| | **C11** | **Min** | **SUM:** | **-196.0** | **-16.0** | **150.4** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002336 | 19.277 |
| 2 | DL | LinStatic | | 0 | 0.002336 | 35.028 |
| 11 | DL | LinStatic | | 0.081 | 0 | 20.727 |
| 12 | DL | LinStatic | | -0.108 | 0 | 19.771 |
| 13 | DL | LinStatic | | 0.072 | 0 | 18.317 |
| 15 | DL | LinStatic | | 0 | 0 | 36.466 |
| 16 | DL | LinStatic | | 0 | 0 | 34.928 |
| 17 | DL | LinStatic | | 0 | 0 | 33.485 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 54.971 | 8.012 | 14.169 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 17.641 |
| 11 | EQ | Combination | Max | 48.535 | 0 | 13.174 |
| 12 | EQ | Combination | Max | 43.094 | 0 | 10.818 |
| 13 | EQ | Combination | Max | 49.39 | 0 | 9.361 |
| 15 | EQ | Combination | Max | 0 | 0 | 13.254 |
| 16 | EQ | Combination | Max | 0 | 0 | 9.176 |
| 17 | EQ | Combination | Max | 0 | 0 | 9.996 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **196.0** | **16.0** | **97.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -54.971 | -8.012 | -14.169 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -17.641 |
| 11 | EQ | Combination | Min | -48.535 | 0 | -13.174 |
| 12 | EQ | Combination | Min | -43.094 | 0 | -10.818 |
| 13 | EQ | Combination | Min | -49.39 | 0 | -9.361 |
| 15 | EQ | Combination | Min | 0 | 0 | -13.254 |
| 16 | EQ | Combination | Min | 0 | 0 | -9.176 |
| 17 | EQ | Combination | Min | 0 | 0 | -9.996 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-196.0** | **-16.0** | **-97.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.009105 | -0.00022 | 2.008 |
| 2 | LL | LinStatic | | 0 | 0.0002204 | 5.491 |
| 11 | LL | LinStatic | | -0.009703 | 0 | 2.008 |
| 12 | LL | LinStatic | | -0.01 | 0 | 2.008 |
| 13 | LL | LinStatic | | 0.011 | 0 | 2.007 |
| 15 | LL | LinStatic | | 0 | 0 | 5.494 |
| 16 | LL | LinStatic | | 0 | 0 | 5.493 |
| 17 | LL | LinStatic | | 0 | 0 | 5.492 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **30.0** |

**Case-12**

| CASE-12: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 43.013 | 8.012 | 9.035 |
| 2 | A1 | NonModHist | Max | 0.026 | 8.012 | 15.341 |
| 11 | A1 | NonModHist | Max | 45.46 | 0 | 10.495 |
| 12 | A1 | NonModHist | Max | 39.023 | 0 | 7.785 |
| 13 | A1 | NonModHist | Max | 41.987 | 0 | 6.365 |
| 15 | A1 | NonModHist | Max | 0 | 0 | 15.727 |
| 16 | A1 | NonModHist | Max | 0 | 0 | 9.662 |
| 17 | A1 | NonModHist | Max | 0 | 0 | 7.938 |
| 500 | A1 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Max | 0 | 0 | 0 |
| | **A1** | **Max** | **SUM:** | **169.5** | **16.0** | **82.3** |
| 1 | A1 | NonModHist | Min | -48.48 | -8.011 | -9.947 |
| 2 | A1 | NonModHist | Min | -0.024 | -8.011 | -15.693 |
| 11 | A1 | NonModHist | Min | -44.848 | 0 | -9.79 |
| 12 | A1 | NonModHist | Min | -36.928 | 0 | -7.907 |
| 13 | A1 | NonModHist | Min | -39.381 | 0 | -5.62 |
| 15 | A1 | NonModHist | Min | 0 | 0 | -13.717 |
| 16 | A1 | NonModHist | Min | 0 | 0 | -8.5 |
| 17 | A1 | NonModHist | Min | 0 | 0 | -9.928 |
| 500 | A1 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A1 | NonModHist | Min | 0 | 0 | 0 |
| | **A1** | **Min** | **SUM:** | **-169.7** | **-16.0** | **-81.1** |
| 1 | A2 | NonModHist | Max | 40.113 | 8.01 | 9.99 |
| 2 | A2 | NonModHist | Max | 0.021 | 8.009 | 15.807 |
| 11 | A2 | NonModHist | Max | 44.939 | 0 | 9.123 |
| 12 | A2 | NonModHist | Max | 35.114 | 0 | 6.96 |
| 13 | A2 | NonModHist | Max | 43.283 | 0 | 6.093 |
| 15 | A2 | NonModHist | Max | 0 | 0 | 15.606 |
| 16 | A2 | NonModHist | Max | 0 | 0 | 8.394 |
| 17 | A2 | NonModHist | Max | 0 | 0 | 12.007 |
| 500 | A2 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Max | 0 | 0 | 0 |
| | **A2** | **Max** | **SUM:** | **163.5** | **16.0** | **84.0** |
| 1 | A2 | NonModHist | Min | -47.261 | -8.01 | -10.14 |
| 2 | A2 | NonModHist | Min | -0.021 | -8.01 | -16.534 |
| 11 | A2 | NonModHist | Min | -35.931 | 0 | -9.463 |
| 12 | A2 | NonModHist | Min | -31.375 | 0 | -6.479 |
| 13 | A2 | NonModHist | Min | -51.405 | 0 | -6.592 |
| 15 | A2 | NonModHist | Min | 0 | 0 | -14.104 |
| 16 | A2 | NonModHist | Min | 0 | 0 | -7.766 |
| 17 | A2 | NonModHist | Min | 0 | 0 | -9.44 |
| 500 | A2 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A2 | NonModHist | Min | 0 | 0 | 0 |
| | **A2** | **Min** | **SUM:** | **-166.0** | **-16.0** | **-80.5** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 48.877 | 8.013 | 11.033 |
| 2 | A3 | NonModHist | Max | 0.025 | 8.012 | 14.772 |
| 11 | A3 | NonModHist | Max | 40.047 | 0 | 10.029 |
| 12 | A3 | NonModHist | Max | 46.552 | 0 | 7.787 |
| 13 | A3 | NonModHist | Max | 36.157 | 0 | 5.896 |
| 15 | A3 | NonModHist | Max | 0 | 0 | 14.888 |
| 16 | A3 | NonModHist | Max | 0 | 0 | 11.412 |
| 17 | A3 | NonModHist | Max | 0 | 0 | 8.577 |
| 500 | A3 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Max | 0 | 0 | 0 |
| | **A3** | **Max** | **SUM:** | **171.7** | **16.0** | **84.4** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -58.245 | -8.013 | -8.819 |
| 2 | A3 | NonModHist | Min | -0.028 | -8.013 | -16.481 |
| 11 | A3 | NonModHist | Min | -41.508 | 0 | -10.915 |
| 12 | A3 | NonModHist | Min | -49.522 | 0 | -7.377 |
| 13 | A3 | NonModHist | Min | -40.243 | 0 | -5.911 |
| 15 | A3 | NonModHist | Min | 0 | 0 | -16.25 |
| 16 | A3 | NonModHist | Min | 0 | 0 | -9.291 |
| 17 | A3 | NonModHist | Min | 0 | 0 | -9.393 |
| 500 | A3 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A3 | NonModHist | Min | 0 | 0 | 0 |
| | **A3** | **Min** | **SUM:** | **-189.5** | **-16.0** | **-84.4** |

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|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 59.076 | 8.011 | 8.748 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 16.632 |
| 11 | A4 | NonModHist | Max | 48.897 | 0 | 14.086 |
| 12 | A4 | NonModHist | Max | 44.933 | 0 | 9.297 |
| 13 | A4 | NonModHist | Max | 36.837 | 0 | 5.709 |
| 15 | A4 | NonModHist | Max | 0 | 0 | 14.301 |
| 16 | A4 | NonModHist | Max | 0 | 0 | 8.943 |
| 17 | A4 | NonModHist | Max | 0 | 0 | 8.924 |
| 500 | A4 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Max | 0 | 0 | 0 |
| | **A4** | **Max** | **SUM:** | **189.8** | **16.0** | **86.6** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -43.818 | -8.011 | -7.792 |
| 2 | A4 | NonModHist | Min | -0.023 | -8.011 | -19.166 |
| 11 | A4 | NonModHist | Min | -40.466 | 0 | -12.574 |
| 12 | A4 | NonModHist | Min | -36.753 | 0 | -8.33 |
| 13 | A4 | NonModHist | Min | -43.682 | 0 | -5.17 |
| 15 | A4 | NonModHist | Min | 0 | 0 | -12.961 |
| 16 | A4 | NonModHist | Min | 0 | 0 | -11.592 |
| 17 | A4 | NonModHist | Min | 0 | 0 | -9.726 |
| 500 | A4 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A4 | NonModHist | Min | 0 | 0 | 0 |
| | **A4** | **Min** | **SUM:** | **-164.7** | **-16.0** | **-87.3** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 58.05 | 8.011 | 9.417 |
| 2 | A5 | NonModHist | Max | 0.023 | 8.011 | 13.337 |
| 11 | A5 | NonModHist | Max | 39.599 | 0 | 10.098 |
| 12 | A5 | NonModHist | Max | 34.725 | 0 | 7.974 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 39.933 | 0 | 5.811 |
| 15 | A5 | NonModHist | Max | 0 | 0 | 14.996 |
| 16 | A5 | NonModHist | Max | 0 | 0 | 9.717 |
| 17 | A5 | NonModHist | Max | 0 | 0 | 9.342 |
| 500 | A5 | NonModHist | Max | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Max | 0 | 0 | 0 |
| | **A5** | **Max** | **SUM:** | **172.3** | **16.0** | **80.7** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -52.912 | -8.014 | -8.416 |
| 2 | A5 | NonModHist | Min | -0.025 | -8.014 | -16.011 |
| 11 | A5 | NonModHist | Min | -52.558 | 0 | -9.902 |
| 12 | A5 | NonModHist | Min | -40.383 | 0 | -7.368 |
| 13 | A5 | NonModHist | Min | -58.477 | 0 | -5.197 |
| 15 | A5 | NonModHist | Min | 0 | 0 | -14.949 |
| 16 | A5 | NonModHist | Min | 0 | 0 | -9.97 |
| 17 | A5 | NonModHist | Min | 0 | 0 | -8.448 |
| 500 | A5 | NonModHist | Min | 0 | 0 | 0 |
| 600 | A5 | NonModHist | Min | 0 | 0 | 0 |
| | **A5** | **Min** | **SUM:** | **-204.4** | **-16.0** | **-80.3** |

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|---|---|---|---|---|---|---|
| 1 | C12 | Combination | Max | 54.185 | 8.01 | 26.209 |
| 2 | C12 | Combination | Max | 0.026 | 8.014 | 62.62 |
| 11 | C12 | Combination | Max | 46.747 | 0 | 28.804 |
| 12 | C12 | Combination | Max | 41.677 | 0 | 24.8 |
| 13 | C12 | Combination | Max | 47.241 | 0 | 21.446 |
| 15 | C12 | Combination | Max | 0 | 0 | 61.886 |
| 16 | C12 | Combination | Max | 0 | 0 | 55.2 |
| 17 | C12 | Combination | Max | 0 | 0 | 54.403 |
| 500 | C12 | Combination | Max | 0 | 0 | 0 |
| 600 | C12 | Combination | Max | 0 | 0 | 0 |
| | **C12** | **Max** | **SUM:** | **189.9** | **16.0** | **335.4** |

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|---|---|---|---|---|---|---|
| 1 | C12 | Combination | Min | -54.26 | -8.014 | 6.495 |
| 2 | C12 | Combination | Min | -0.026 | -8.01 | 29.066 |
| 11 | C12 | Combination | Min | -46.598 | 0 | 6.782 |
| 12 | C12 | Combination | Min | -41.913 | 0 | 8.831 |
| 13 | C12 | Combination | Min | -47.077 | 0 | 9.291 |
| 15 | C12 | Combination | Min | 0 | 0 | 31.134 |
| 16 | C12 | Combination | Min | 0 | 0 | 34.787 |
| 17 | C12 | Combination | Min | 0 | 0 | 34.245 |
| 500 | C12 | Combination | Min | 0 | 0 | 0 |
| 600 | C12 | Combination | Min | 0 | 0 | 0 |
| | **C12** | **Min** | **SUM:** | **-189.9** | **-16.0** | **160.6** |

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|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.045 | -0.002066 | 15.389 |
| 2 | DL | LinStatic | | 0 | 0.002066 | 39.276 |
| 11 | DL | LinStatic | | 0.082 | 0 | 16.832 |
| 12 | DL | LinStatic | | -0.109 | 0 | 15.854 |
| 13 | DL | LinStatic | | 0.072 | 0 | 14.405 |
| 15 | DL | LinStatic | | 0 | 0 | 40.001 |
| 16 | DL | LinStatic | | 0 | 0 | 38.485 |
| 17 | DL | LinStatic | | 0 | 0 | 37.757 |

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|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0 | 0 | 0 |
| 600 | DL | LinStatic | | 0 | 0 | 0 |
| | **DL** | **0** | **SUM:** | **0.0** | **0.0** | **218.0** |

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|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 54.222 | 8.012 | 9.857 |
| 2 | EQ | Combination | Max | 0.026 | 8.012 | 16.777 |
| 11 | EQ | Combination | Max | 46.672 | 0 | 11.011 |
| 12 | EQ | Combination | Max | 41.795 | 0 | 7.985 |
| 13 | EQ | Combination | Max | 47.159 | 0 | 6.077 |
| 15 | EQ | Combination | Max | 0 | 0 | 15.376 |
| 16 | EQ | Combination | Max | 0 | 0 | 10.206 |
| 17 | EQ | Combination | Max | 0 | 0 | 10.079 |
| 500 | EQ | Combination | Max | 0 | 0 | 0 |
| 600 | EQ | Combination | Max | 0 | 0 | 0 |
| | **EQ** | **Max** | **SUM:** | **189.9** | **16.0** | **87.4** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -54.222 | -8.012 | -9.857 |
| 2 | EQ | Combination | Min | -0.026 | -8.012 | -16.777 |
| 11 | EQ | Combination | Min | -46.672 | 0 | -11.011 |
| 12 | EQ | Combination | Min | -41.795 | 0 | -7.985 |
| 13 | EQ | Combination | Min | -47.159 | 0 | -6.077 |
| 15 | EQ | Combination | Min | 0 | 0 | -15.376 |
| 16 | EQ | Combination | Min | 0 | 0 | -10.206 |
| 17 | EQ | Combination | Min | 0 | 0 | -10.079 |
| 500 | EQ | Combination | Min | 0 | 0 | 0 |
| 600 | EQ | Combination | Min | 0 | 0 | 0 |
| | **EQ** | **Min** | **SUM:** | **-189.9** | **-16.0** | **-87.4** |

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|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.007074 | -0.000385 | 0.963 |
| 2 | LL | LinStatic | | 0 | 0.0003854 | 6.567 |
| 11 | LL | LinStatic | | -0.008119 | 0 | 0.961 |
| 12 | LL | LinStatic | | -0.008889 | 0 | 0.962 |
| 13 | LL | LinStatic | | 0.009934 | 0 | 0.963 |
| 15 | LL | LinStatic | | 0 | 0 | 6.509 |
| 16 | LL | LinStatic | | 0 | 0 | 6.508 |
| 17 | LL | LinStatic | | 0 | 0 | 6.567 |
| 500 | LL | LinStatic | | 0 | 0 | 0 |
| 600 | LL | LinStatic | | 0 | 0 | 0 |
| | **LL** | **0** | **SUM:** | **0.0** | **0.0** | **30.0** |

**Case-13**

| CASE-13: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 39.77 | 8.01 | 12.35 |
| 2 | A1 | NonModHist | Max | 0.03 | 8.01 | 13.49 |
| 11 | A1 | NonModHist | Max | 48.78 | 0.00 | 10.87 |
| 12 | A1 | NonModHist | Max | 38.49 | 0.00 | 8.18 |
| 13 | A1 | NonModHist | Max | 40.79 | 0.00 | 8.54 |
| 15 | A1 | NonModHist | Max | 0.00 | 0.00 | 10.96 |
| 16 | A1 | NonModHist | Max | 0.00 | 0.00 | 8.10 |
| 17 | A1 | NonModHist | Max | 0.00 | 0.00 | 10.67 |
| 500 | A1 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A1 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A1** | **Max** | **SUM:** | **167.85** | **16.02** | **83.15** |
| 1 | A1 | NonModHist | Min | -41.86 | -8.01 | -12.09 |
| 2 | A1 | NonModHist | Min | -0.02 | -8.01 | -13.88 |
| 11 | A1 | NonModHist | Min | -48.39 | 0.00 | -12.11 |
| 12 | A1 | NonModHist | Min | -34.45 | 0.00 | -6.95 |
| 13 | A1 | NonModHist | Min | -37.27 | 0.00 | -10.25 |
| 15 | A1 | NonModHist | Min | 0.00 | 0.00 | -13.77 |
| 16 | A1 | NonModHist | Min | 0.00 | 0.00 | -7.48 |
| 17 | A1 | NonModHist | Min | 0.00 | 0.00 | -12.63 |
| 500 | A1 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A1 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A1** | **Min** | **SUM:** | **-162.00** | **-16.02** | **-89.14** |
| 1 | A2 | NonModHist | Max | 41.85 | 8.01 | 11.90 |
| 2 | A2 | NonModHist | Max | 0.02 | 8.01 | 13.94 |
| 11 | A2 | NonModHist | Max | 50.69 | 0.00 | 11.60 |
| 12 | A2 | NonModHist | Max | 45.66 | 0.00 | 7.99 |
| 13 | A2 | NonModHist | Max | 42.49 | 0.00 | 9.13 |
| 15 | A2 | NonModHist | Max | 0.00 | 0.00 | 11.06 |
| 16 | A2 | NonModHist | Max | 0.00 | 0.00 | 7.41 |
| 17 | A2 | NonModHist | Max | 0.00 | 0.00 | 11.10 |
| 500 | A2 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A2 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A2** | **Max** | **SUM:** | **180.72** | **16.02** | **84.15** |
| 1 | A2 | NonModHist | Min | -34.93 | -8.01 | -11.96 |
| 2 | A2 | NonModHist | Min | -0.02 | -8.01 | -15.76 |
| 11 | A2 | NonModHist | Min | -44.20 | 0.00 | -12.18 |
| 12 | A2 | NonModHist | Min | -37.65 | 0.00 | -7.36 |
| 13 | A2 | NonModHist | Min | -35.58 | 0.00 | -9.64 |
| 15 | A2 | NonModHist | Min | 0.00 | 0.00 | -12.73 |
| 16 | A2 | NonModHist | Min | 0.00 | 0.00 | -8.44 |
| 17 | A2 | NonModHist | Min | 0.00 | 0.00 | -11.17 |
| 500 | A2 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A2 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A2** | **Min** | **SUM:** | **-152.38** | **-16.02** | **-89.23** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 51.45 | 8.01 | 12.40 |
| 2 | A3 | NonModHist | Max | 0.03 | 8.01 | 13.45 |
| 11 | A3 | NonModHist | Max | 44.77 | 0.00 | 12.02 |
| 12 | A3 | NonModHist | Max | 56.08 | 0.00 | 8.21 |
| 13 | A3 | NonModHist | Max | 35.15 | 0.00 | 10.11 |
| 15 | A3 | NonModHist | Max | 0.00 | 0.00 | 12.51 |
| 16 | A3 | NonModHist | Max | 0.00 | 0.00 | 8.67 |
| 17 | A3 | NonModHist | Max | 0.00 | 0.00 | 12.35 |
| 500 | A3 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A3 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A3** | **Max** | **SUM:** | **187.48** | **16.03** | **89.71** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -49.54 | -8.01 | -14.57 |
| 2 | A3 | NonModHist | Min | -0.03 | -8.01 | -16.98 |
| 11 | A3 | NonModHist | Min | -51.47 | 0.00 | -13.34 |
| 12 | A3 | NonModHist | Min | -49.61 | 0.00 | -8.76 |
| 13 | A3 | NonModHist | Min | -42.80 | 0.00 | -9.91 |
| 15 | A3 | NonModHist | Min | 0.00 | 0.00 | -13.28 |
| 16 | A3 | NonModHist | Min | 0.00 | 0.00 | -8.43 |
| 17 | A3 | NonModHist | Min | 0.00 | 0.00 | -10.81 |
| 500 | A3 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A3 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A3** | **Min** | **SUM:** | **-193.44** | **-16.02** | **-96.08** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 38.66 | 8.01 | 12.57 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 15.47 |
| 11 | A4 | NonModHist | Max | 62.76 | 0.00 | 9.85 |
| 12 | A4 | NonModHist | Max | 40.84 | 0.00 | 8.27 |
| 13 | A4 | NonModHist | Max | 56.84 | 0.00 | 10.30 |
| 15 | A4 | NonModHist | Max | 0.00 | 0.00 | 10.80 |
| 16 | A4 | NonModHist | Max | 0.00 | 0.00 | 7.74 |
| 17 | A4 | NonModHist | Max | 0.00 | 0.00 | 10.97 |
| 500 | A4 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A4 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A4** | **Max** | **SUM:** | **199.14** | **16.02** | **85.97** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -34.00 | -8.01 | -12.83 |
| 2 | A4 | NonModHist | Min | -0.02 | -8.01 | -15.95 |
| 11 | A4 | NonModHist | Min | -44.99 | 0.00 | -11.90 |
| 12 | A4 | NonModHist | Min | -33.54 | 0.00 | -11.15 |
| 13 | A4 | NonModHist | Min | -35.37 | 0.00 | -8.57 |
| 15 | A4 | NonModHist | Min | 0.00 | 0.00 | -11.01 |
| 16 | A4 | NonModHist | Min | 0.00 | 0.00 | -12.71 |
| 17 | A4 | NonModHist | Min | 0.00 | 0.00 | -10.49 |
| 500 | A4 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A4 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A4** | **Min** | **SUM:** | **-147.92** | **-16.02** | **-94.60** |

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|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 41.64 | 8.01 | 11.49 |
| 2 | A5 | NonModHist | Max | 0.02 | 8.01 | 14.88 |
| 11 | A5 | NonModHist | Max | 40.70 | 0.00 | 12.15 |
| 12 | A5 | NonModHist | Max | 41.12 | 0.00 | 9.27 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 34.45 | 0.00 | 10.88 |
| 15 | A5 | NonModHist | Max | 0.00 | 0.00 | 13.02 |
| 16 | A5 | NonModHist | Max | 0.00 | 0.00 | 9.18 |
| 17 | A5 | NonModHist | Max | 0.00 | 0.00 | 12.06 |
| 500 | A5 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A5 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A5** | **Max** | **SUM:** | **157.93** | **16.02** | **92.91** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -46.42 | -8.01 | -12.68 |
| 2 | A5 | NonModHist | Min | -0.03 | -8.01 | -13.79 |
| 11 | A5 | NonModHist | Min | -45.76 | 0.00 | -14.79 |
| 12 | A5 | NonModHist | Min | -47.74 | 0.00 | -8.32 |
| 13 | A5 | NonModHist | Min | -37.77 | 0.00 | -9.35 |
| 15 | A5 | NonModHist | Min | 0.00 | 0.00 | -13.45 |
| 16 | A5 | NonModHist | Min | 0.00 | 0.00 | -8.66 |
| 17 | A5 | NonModHist | Min | 0.00 | 0.00 | -10.33 |
| 500 | A5 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A5 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A5** | **Min** | **SUM:** | **-177.71** | **-16.03** | **-91.36** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C13 | Combination | Max | 44.00 | 8.01 | 43.15 |
| 2 | C13 | Combination | Max | 0.03 | 8.01 | 47.02 |
| 11 | C13 | Combination | Max | 52.00 | 0.00 | 44.59 |
| 12 | C13 | Combination | Max | 45.57 | 0.00 | 39.61 |
| 13 | C13 | Combination | Max | 44.27 | 0.00 | 39.32 |
| 15 | C13 | Combination | Max | 0.00 | 0.00 | 45.82 |
| 16 | C13 | Combination | Max | 0.00 | 0.00 | 41.09 |
| 17 | C13 | Combination | Max | 0.00 | 0.00 | 42.05 |
| 500 | C13 | Combination | Max | 0.00 | 0.00 | 0.00 |
| 600 | C13 | Combination | Max | 0.00 | 0.00 | 0.00 |
| | **C13** | **Max** | **SUM:** | **185.86** | **16.02** | **342.63** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C13 | Combination | Min | -44.10 | -8.01 | 17.40 |
| 2 | C13 | Combination | Min | -0.03 | -8.01 | 16.03 |
| 11 | C13 | Combination | Min | -51.78 | 0.00 | 18.87 |
| 12 | C13 | Combination | Min | -45.95 | 0.00 | 21.47 |
| 13 | C13 | Combination | Min | -44.01 | 0.00 | 18.85 |
| 15 | C13 | Combination | Min | 0.00 | 0.00 | 20.12 |
| 16 | C13 | Combination | Min | 0.00 | 0.00 | 22.25 |
| 17 | C13 | Combination | Min | 0.00 | 0.00 | 18.38 |
| 500 | C13 | Combination | Min | 0.00 | 0.00 | 0.00 |
| 600 | C13 | Combination | Min | 0.00 | 0.00 | 0.00 |
| | **C13** | **Min** | **SUM:** | **-185.86** | **-16.02** | **153.37** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.06 | 0.00 | 26.39 |
| 2 | DL | LinStatic | | 0.00 | 0.00 | 27.91 |
| 11 | DL | LinStatic | | 0.13 | 0.00 | 27.85 |
| 12 | DL | LinStatic | | -0.18 | 0.00 | 26.66 |
| 13 | DL | LinStatic | | 0.11 | 0.00 | 25.20 |
| 15 | DL | LinStatic | | 0.00 | 0.00 | 29.35 |
| 16 | DL | LinStatic | | 0.00 | 0.00 | 28.05 |
| 17 | DL | LinStatic | | 0.00 | 0.00 | 26.60 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0.00 | 0.00 | 0.00 |
| 600 | DL | LinStatic | | 0.00 | 0.00 | 0.00 |
| | **DL** | **0** | **SUM:** | **0.00** | **0.00** | **218.00** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 44.05 | 8.01 | 12.88 |
| 2 | EQ | Combination | Max | 0.03 | 8.01 | 15.49 |
| 11 | EQ | Combination | Max | 51.89 | 0.00 | 12.86 |
| 12 | EQ | Combination | Max | 45.76 | 0.00 | 9.07 |
| 13 | EQ | Combination | Max | 44.14 | 0.00 | 10.24 |
| 15 | EQ | Combination | Max | 0.00 | 0.00 | 12.85 |
| 16 | EQ | Combination | Max | 0.00 | 0.00 | 9.42 |
| 17 | EQ | Combination | Max | 0.00 | 0.00 | 11.84 |
| 500 | EQ | Combination | Max | 0.00 | 0.00 | 0.00 |
| 600 | EQ | Combination | Max | 0.00 | 0.00 | 0.00 |
| | **EQ** | **Max** | **SUM:** | **185.86** | **16.02** | **94.63** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -44.05 | -8.01 | -12.88 |
| 2 | EQ | Combination | Min | -0.03 | -8.01 | -15.49 |
| 11 | EQ | Combination | Min | -51.89 | 0.00 | -12.86 |
| 12 | EQ | Combination | Min | -45.76 | 0.00 | -9.07 |
| 13 | EQ | Combination | Min | -44.14 | 0.00 | -10.24 |
| 15 | EQ | Combination | Min | 0.00 | 0.00 | -12.85 |
| 16 | EQ | Combination | Min | 0.00 | 0.00 | -9.42 |
| 17 | EQ | Combination | Min | 0.00 | 0.00 | -11.84 |
| 500 | EQ | Combination | Min | 0.00 | 0.00 | 0.00 |
| 600 | EQ | Combination | Min | 0.00 | 0.00 | 0.00 |
| | **EQ** | **Min** | **SUM:** | **-185.86** | **-16.02** | **-94.63** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.02 | 0.00 | 3.88 |
| 2 | LL | LinStatic | | 0.00 | 0.00 | 3.62 |
| 11 | LL | LinStatic | | -0.02 | 0.00 | 3.88 |
| 12 | LL | LinStatic | | -0.02 | 0.00 | 3.88 |
| 13 | LL | LinStatic | | 0.02 | 0.00 | 3.88 |
| 15 | LL | LinStatic | | 0.00 | 0.00 | 3.62 |
| 16 | LL | LinStatic | | 0.00 | 0.00 | 3.62 |
| 17 | LL | LinStatic | | 0.00 | 0.00 | 3.62 |
| 500 | LL | LinStatic | | 0.00 | 0.00 | 0.00 |
| 600 | LL | LinStatic | | 0.00 | 0.00 | 0.00 |
| | **LL** | **0** | **SUM:** | **0.00** | **0.00** | **30.00** |

**Case-14**

| CASE-14: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | F1 | F2 | F3 |
| No | Case | Type | Type | Kip | Kip | Kip |
| 1 | A1 | NonModHist | Max | 49.37 | 8.01 | 11.30 |
| 2 | A1 | NonModHist | Max | 0.03 | 8.01 | 15.64 |
| 11 | A1 | NonModHist | Max | 45.53 | 0.00 | 12.39 |
| 12 | A1 | NonModHist | Max | 35.39 | 0.00 | 12.41 |
| 13 | A1 | NonModHist | Max | 44.78 | 0.00 | 8.35 |
| 15 | A1 | NonModHist | Max | 0.00 | 0.00 | 14.33 |
| 16 | A1 | NonModHist | Max | 0.00 | 0.00 | 7.60 |
| 17 | A1 | NonModHist | Max | 0.00 | 0.00 | 10.46 |
| 500 | A1 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A1 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A1** | **Max** | **SUM:** | **175.10** | **16.02** | **92.47** |
| 1 | A1 | NonModHist | Min | -37.34 | -8.01 | -12.04 |
| 2 | A1 | NonModHist | Min | -0.02 | -8.01 | -15.55 |
| 11 | A1 | NonModHist | Min | -40.74 | 0.00 | -12.45 |
| 12 | A1 | NonModHist | Min | -36.65 | 0.00 | -10.79 |
| 13 | A1 | NonModHist | Min | -48.73 | 0.00 | -7.42 |
| 15 | A1 | NonModHist | Min | 0.00 | 0.00 | -12.79 |
| 16 | A1 | NonModHist | Min | 0.00 | 0.00 | -7.31 |
| 17 | A1 | NonModHist | Min | 0.00 | 0.00 | -8.58 |
| 500 | A1 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A1 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A1** | **Min** | **SUM:** | **-163.48** | **-16.02** | **-86.94** |
| 1 | A2 | NonModHist | Max | 37.68 | 8.01 | 13.28 |
| 2 | A2 | NonModHist | Max | 0.02 | 8.01 | 15.68 |
| 11 | A2 | NonModHist | Max | 46.33 | 0.00 | 15.62 |
| 12 | A2 | NonModHist | Max | 39.42 | 0.00 | 9.99 |
| 13 | A2 | NonModHist | Max | 50.47 | 0.00 | 8.94 |
| 15 | A2 | NonModHist | Max | 0.00 | 0.00 | 14.86 |
| 16 | A2 | NonModHist | Max | 0.00 | 0.00 | 8.62 |
| 17 | A2 | NonModHist | Max | 0.00 | 0.00 | 10.46 |
| 500 | A2 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A2 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A2** | **Max** | **SUM:** | **173.92** | **16.02** | **97.44** |
| 1 | A2 | NonModHist | Min | -53.13 | -8.01 | -13.52 |
| 2 | A2 | NonModHist | Min | -0.02 | -8.01 | -17.96 |
| 11 | A2 | NonModHist | Min | -38.61 | 0.00 | -13.67 |
| 12 | A2 | NonModHist | Min | -38.81 | 0.00 | -10.62 |
| 13 | A2 | NonModHist | Min | -53.70 | 0.00 | -8.95 |
| 15 | A2 | NonModHist | Min | 0.00 | 0.00 | -13.59 |
| 16 | A2 | NonModHist | Min | 0.00 | 0.00 | -8.01 |
| 17 | A2 | NonModHist | Min | 0.00 | 0.00 | -11.33 |
| 500 | A2 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A2 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A2** | **Min** | **SUM:** | **-184.26** | **-16.02** | **-97.66** |

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|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 48.08 | 8.01 | 12.66 |
| 2 | A3 | NonModHist | Max | 0.03 | 8.01 | 13.16 |
| 11 | A3 | NonModHist | Max | 37.13 | 0.00 | 13.58 |
| 12 | A3 | NonModHist | Max | 46.85 | 0.00 | 11.39 |
| 13 | A3 | NonModHist | Max | 37.54 | 0.00 | 7.83 |
| 15 | A3 | NonModHist | Max | 0.00 | 0.00 | 17.31 |
| 16 | A3 | NonModHist | Max | 0.00 | 0.00 | 9.25 |
| 17 | A3 | NonModHist | Max | 0.00 | 0.00 | 9.50 |
| 500 | A3 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A3 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A3** | **Max** | **SUM:** | **169.63** | **16.03** | **94.68** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -60.17 | -8.01 | -11.30 |
| 2 | A3 | NonModHist | Min | -0.03 | -8.01 | -15.08 |
| 11 | A3 | NonModHist | Min | -43.43 | 0.00 | -14.40 |
| 12 | A3 | NonModHist | Min | -52.39 | 0.00 | -11.08 |
| 13 | A3 | NonModHist | Min | -40.97 | 0.00 | -7.46 |
| 15 | A3 | NonModHist | Min | 0.00 | 0.00 | -14.11 |
| 16 | A3 | NonModHist | Min | 0.00 | 0.00 | -10.04 |
| 17 | A3 | NonModHist | Min | 0.00 | 0.00 | -9.94 |
| 500 | A3 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A3 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A3** | **Min** | **SUM:** | **-196.99** | **-16.03** | **-93.42** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 53.98 | 8.01 | 12.68 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 15.95 |
| 11 | A4 | NonModHist | Max | 50.33 | 0.00 | 15.98 |
| 12 | A4 | NonModHist | Max | 44.93 | 0.00 | 11.62 |
| 13 | A4 | NonModHist | Max | 42.37 | 0.00 | 7.47 |
| 15 | A4 | NonModHist | Max | 0.00 | 0.00 | 13.68 |
| 16 | A4 | NonModHist | Max | 0.00 | 0.00 | 9.20 |
| 17 | A4 | NonModHist | Max | 0.00 | 0.00 | 9.45 |
| 500 | A4 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A4 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A4** | **Max** | **SUM:** | **191.64** | **16.02** | **96.02** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -46.19 | -8.01 | -9.81 |
| 2 | A4 | NonModHist | Min | -0.02 | -8.01 | -16.82 |
| 11 | A4 | NonModHist | Min | -41.68 | 0.00 | -15.23 |
| 12 | A4 | NonModHist | Min | -35.01 | 0.00 | -9.37 |
| 13 | A4 | NonModHist | Min | -45.00 | 0.00 | -7.23 |
| 15 | A4 | NonModHist | Min | 0.00 | 0.00 | -12.81 |
| 16 | A4 | NonModHist | Min | 0.00 | 0.00 | -9.64 |
| 17 | A4 | NonModHist | Min | 0.00 | 0.00 | -9.32 |
| 500 | A4 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A4 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A4** | **Min** | **SUM:** | **-167.89** | **-16.02** | **-90.23** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 57.48 | 8.01 | 9.74 |
| 2 | A5 | NonModHist | Max | 0.02 | 8.01 | 16.39 |
| 11 | A5 | NonModHist | Max | 41.67 | 0.00 | 16.11 |
| 12 | A5 | NonModHist | Max | 32.27 | 0.00 | 13.47 |

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|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 47.49 | 0.00 | 6.91 |
| 15 | A5 | NonModHist | Max | 0.00 | 0.00 | 15.82 |
| 16 | A5 | NonModHist | Max | 0.00 | 0.00 | 10.84 |
| 17 | A5 | NonModHist | Max | 0.00 | 0.00 | 8.89 |
| 500 | A5 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A5 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A5** | **Max** | **SUM:** | **178.93** | **16.02** | **98.15** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -54.90 | -8.01 | -9.00 |
| 2 | A5 | NonModHist | Min | -0.03 | -8.01 | -16.94 |
| 11 | A5 | NonModHist | Min | -57.62 | 0.00 | -14.26 |
| 12 | A5 | NonModHist | Min | -41.44 | 0.00 | -11.51 |
| 13 | A5 | NonModHist | Min | -58.31 | 0.00 | -6.61 |
| 15 | A5 | NonModHist | Min | 0.00 | 0.00 | -14.20 |
| 16 | A5 | NonModHist | Min | 0.00 | 0.00 | -9.51 |
| 17 | A5 | NonModHist | Min | 0.00 | 0.00 | -10.82 |
| 500 | A5 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A5 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A5** | **Min** | **SUM:** | **-212.29** | **-16.03** | **-92.85** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C14 | Combination | Max | 54.79 | 8.01 | 33.41 |
| 2 | C14 | Combination | Max | 0.03 | 8.02 | 57.01 |
| 11 | C14 | Combination | Max | 48.72 | 0.00 | 37.64 |
| 12 | C14 | Combination | Max | 42.85 | 0.00 | 33.68 |
| 13 | C14 | Combination | Max | 49.42 | 0.00 | 28.23 |
| 15 | C14 | Combination | Max | 0.00 | 0.00 | 57.16 |
| 16 | C14 | Combination | Max | 0.00 | 0.00 | 49.77 |
| 17 | C14 | Combination | Max | 0.00 | 0.00 | 49.38 |
| 500 | C14 | Combination | Max | 0.00 | 0.00 | 0.00 |
| 600 | C14 | Combination | Max | 0.00 | 0.00 | 0.00 |
| | **C14** | **Max** | **SUM:** | **195.81** | **16.02** | **346.27** |

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|---|---|---|---|---|---|---|
| 1 | C14 | Combination | Min | -54.86 | -8.02 | 9.16 |
| 2 | C14 | Combination | Min | -0.03 | -8.01 | 24.03 |
| 11 | C14 | Combination | Min | -48.57 | 0.00 | 7.83 |
| 12 | C14 | Combination | Min | -43.09 | 0.00 | 9.88 |
| 13 | C14 | Combination | Min | -49.26 | 0.00 | 12.42 |
| 15 | C14 | Combination | Min | 0.00 | 0.00 | 26.76 |
| 16 | C14 | Combination | Min | 0.00 | 0.00 | 31.08 |
| 17 | C14 | Combination | Min | 0.00 | 0.00 | 28.58 |
| 500 | C14 | Combination | Min | 0.00 | 0.00 | 0.00 |
| 600 | C14 | Combination | Min | 0.00 | 0.00 | 0.00 |
| | **C14** | **Min** | **SUM:** | **-195.81** | **-16.02** | **149.73** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.05 | 0.00 | 19.28 |
| 2 | DL | LinStatic | | 0.00 | 0.00 | 35.03 |
| 11 | DL | LinStatic | | 0.08 | 0.00 | 20.73 |
| 12 | DL | LinStatic | | -0.11 | 0.00 | 19.77 |
| 13 | DL | LinStatic | | 0.07 | 0.00 | 18.32 |
| 15 | DL | LinStatic | | 0.00 | 0.00 | 36.47 |
| 16 | DL | LinStatic | | 0.00 | 0.00 | 34.93 |
| 17 | DL | LinStatic | | 0.00 | 0.00 | 33.49 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0.00 | 0.00 | 0.00 |
| 600 | DL | LinStatic | | 0.00 | 0.00 | 0.00 |
| | **DL** | **0** | **SUM:** | **0.00** | **0.00** | **218.00** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 54.83 | 8.01 | 12.13 |
| 2 | EQ | Combination | Max | 0.03 | 8.01 | 16.49 |
| 11 | EQ | Combination | Max | 48.65 | 0.00 | 14.91 |
| 12 | EQ | Combination | Max | 42.97 | 0.00 | 11.90 |
| 13 | EQ | Combination | Max | 49.34 | 0.00 | 7.90 |
| 15 | EQ | Combination | Max | 0.00 | 0.00 | 15.20 |
| 16 | EQ | Combination | Max | 0.00 | 0.00 | 9.35 |
| 17 | EQ | Combination | Max | 0.00 | 0.00 | 10.40 |
| 500 | EQ | Combination | Max | 0.00 | 0.00 | 0.00 |
| 600 | EQ | Combination | Max | 0.00 | 0.00 | 0.00 |
| | **EQ** | **Max** | **SUM:** | **195.81** | **16.02** | **98.27** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -54.83 | -8.01 | -12.13 |
| 2 | EQ | Combination | Min | -0.03 | -8.01 | -16.49 |
| 11 | EQ | Combination | Min | -48.65 | 0.00 | -14.91 |
| 12 | EQ | Combination | Min | -42.97 | 0.00 | -11.90 |
| 13 | EQ | Combination | Min | -49.34 | 0.00 | -7.90 |
| 15 | EQ | Combination | Min | 0.00 | 0.00 | -15.20 |
| 16 | EQ | Combination | Min | 0.00 | 0.00 | -9.35 |
| 17 | EQ | Combination | Min | 0.00 | 0.00 | -10.40 |
| 500 | EQ | Combination | Min | 0.00 | 0.00 | 0.00 |
| 600 | EQ | Combination | Min | 0.00 | 0.00 | 0.00 |
| | **EQ** | **Min** | **SUM:** | **-195.81** | **-16.02** | **-98.27** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.01 | 0.00 | 2.01 |
| 2 | LL | LinStatic | | 0.00 | 0.00 | 5.49 |
| 11 | LL | LinStatic | | -0.01 | 0.00 | 2.01 |
| 12 | LL | LinStatic | | -0.01 | 0.00 | 2.01 |
| 13 | LL | LinStatic | | 0.01 | 0.00 | 2.01 |
| 15 | LL | LinStatic | | 0.00 | 0.00 | 5.49 |
| 16 | LL | LinStatic | | 0.00 | 0.00 | 5.49 |
| 17 | LL | LinStatic | | 0.00 | 0.00 | 5.49 |
| 500 | LL | LinStatic | | 0.00 | 0.00 | 0.00 |
| 600 | LL | LinStatic | | 0.00 | 0.00 | 0.00 |
| | **LL** | **0** | **SUM:** | **0.00** | **0.00** | **30.00** |

**Case-15**

| CASE-15: Joint Reactions | | | | | | |
|---|---|---|---|---|---|---|
| Joint No | Output Case | Case Type | Step Type | F1 Kip | F2 Kip | F3 Kip |
| 1 | A1 | NonModHist | Max | 44.36 | 8.01 | 8.74 |
| 2 | A1 | NonModHist | Max | 0.03 | 8.01 | 17.37 |
| 11 | A1 | NonModHist | Max | 46.19 | 0.00 | 9.09 |
| 12 | A1 | NonModHist | Max | 39.04 | 0.00 | 7.16 |
| 13 | A1 | NonModHist | Max | 42.30 | 0.00 | 5.21 |
| 15 | A1 | NonModHist | Max | 0.00 | 0.00 | 15.47 |
| 16 | A1 | NonModHist | Max | 0.00 | 0.00 | 9.60 |
| 17 | A1 | NonModHist | Max | 0.00 | 0.00 | 10.93 |
| 500 | A1 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A1 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A1** | **Max** | **SUM:** | **171.91** | **16.02** | **83.57** |
| 1 | A1 | NonModHist | Min | -45.47 | -8.01 | -8.33 |
| 2 | A1 | NonModHist | Min | -0.02 | -8.01 | -16.87 |
| 11 | A1 | NonModHist | Min | -45.26 | 0.00 | -8.96 |
| 12 | A1 | NonModHist | Min | -33.49 | 0.00 | -6.82 |
| 13 | A1 | NonModHist | Min | -40.23 | 0.00 | -6.03 |
| 15 | A1 | NonModHist | Min | 0.00 | 0.00 | -15.06 |
| 16 | A1 | NonModHist | Min | 0.00 | 0.00 | -8.35 |
| 17 | A1 | NonModHist | Min | 0.00 | 0.00 | -11.46 |
| 500 | A1 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A1 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A1** | **Min** | **SUM:** | **-164.48** | **-16.02** | **-81.89** |
| 1 | A2 | NonModHist | Max | 39.70 | 8.01 | 9.55 |
| 2 | A2 | NonModHist | Max | 0.02 | 8.01 | 18.06 |
| 11 | A2 | NonModHist | Max | 45.56 | 0.00 | 7.62 |
| 12 | A2 | NonModHist | Max | 35.97 | 0.00 | 5.99 |
| 13 | A2 | NonModHist | Max | 44.92 | 0.00 | 6.81 |
| 15 | A2 | NonModHist | Max | 0.00 | 0.00 | 16.13 |
| 16 | A2 | NonModHist | Max | 0.00 | 0.00 | 7.76 |
| 17 | A2 | NonModHist | Max | 0.00 | 0.00 | 11.78 |
| 500 | A2 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A2 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A2** | **Max** | **SUM:** | **166.18** | **16.02** | **83.68** |
| 1 | A2 | NonModHist | Min | -49.67 | -8.01 | -10.22 |
| 2 | A2 | NonModHist | Min | -0.02 | -8.01 | -17.20 |
| 11 | A2 | NonModHist | Min | -37.34 | 0.00 | -8.05 |
| 12 | A2 | NonModHist | Min | -30.78 | 0.00 | -5.94 |
| 13 | A2 | NonModHist | Min | -51.19 | 0.00 | -5.99 |
| 15 | A2 | NonModHist | Min | 0.00 | 0.00 | -13.05 |
| 16 | A2 | NonModHist | Min | 0.00 | 0.00 | -7.67 |
| 17 | A2 | NonModHist | Min | 0.00 | 0.00 | -9.98 |
| 500 | A2 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A2 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A2** | **Min** | **SUM:** | **-169.00** | **-16.02** | **-78.09** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Max | 49.26 | 8.01 | 10.23 |
| 2 | A3 | NonModHist | Max | 0.03 | 8.01 | 14.90 |
| 11 | A3 | NonModHist | Max | 39.43 | 0.00 | 9.23 |
| 12 | A3 | NonModHist | Max | 44.51 | 0.00 | 7.08 |
| 13 | A3 | NonModHist | Max | 34.33 | 0.00 | 5.38 |
| 15 | A3 | NonModHist | Max | 0.00 | 0.00 | 16.27 |
| 16 | A3 | NonModHist | Max | 0.00 | 0.00 | 10.59 |
| 17 | A3 | NonModHist | Max | 0.00 | 0.00 | 11.12 |
| 500 | A3 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A3 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A3** | **Max** | **SUM:** | **167.56** | **16.03** | **84.79** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A3 | NonModHist | Min | -57.49 | -8.01 | -10.43 |
| 2 | A3 | NonModHist | Min | -0.03 | -8.01 | -15.56 |
| 11 | A3 | NonModHist | Min | -42.19 | 0.00 | -10.42 |
| 12 | A3 | NonModHist | Min | -49.28 | 0.00 | -7.21 |
| 13 | A3 | NonModHist | Min | -43.12 | 0.00 | -6.15 |
| 15 | A3 | NonModHist | Min | 0.00 | 0.00 | -15.93 |
| 16 | A3 | NonModHist | Min | 0.00 | 0.00 | -10.97 |
| 17 | A3 | NonModHist | Min | 0.00 | 0.00 | -12.17 |
| 500 | A3 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A3 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A3** | **Min** | **SUM:** | **-192.11** | **-16.03** | **-88.84** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Max | 61.20 | 8.01 | 7.49 |
| 2 | A4 | NonModHist | Max | 0.03 | 8.01 | 15.54 |
| 11 | A4 | NonModHist | Max | 49.53 | 0.00 | 11.27 |
| 12 | A4 | NonModHist | Max | 47.57 | 0.00 | 8.15 |
| 13 | A4 | NonModHist | Max | 38.26 | 0.00 | 4.95 |
| 15 | A4 | NonModHist | Max | 0.00 | 0.00 | 13.74 |
| 16 | A4 | NonModHist | Max | 0.00 | 0.00 | 9.41 |
| 17 | A4 | NonModHist | Max | 0.00 | 0.00 | 10.90 |
| 500 | A4 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A4 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A4** | **Max** | **SUM:** | **196.59** | **16.02** | **81.45** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A4 | NonModHist | Min | -45.29 | -8.01 | -7.41 |
| 2 | A4 | NonModHist | Min | -0.02 | -8.01 | -19.71 |
| 11 | A4 | NonModHist | Min | -39.94 | 0.00 | -11.64 |
| 12 | A4 | NonModHist | Min | -36.95 | 0.00 | -7.81 |
| 13 | A4 | NonModHist | Min | -46.12 | 0.00 | -4.58 |
| 15 | A4 | NonModHist | Min | 0.00 | 0.00 | -14.03 |
| 16 | A4 | NonModHist | Min | 0.00 | 0.00 | -9.63 |
| 17 | A4 | NonModHist | Min | 0.00 | 0.00 | -9.71 |
| 500 | A4 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A4 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A4** | **Min** | **SUM:** | **-168.32** | **-16.02** | **-84.52** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Max | 54.02 | 8.01 | 7.44 |
| 2 | A5 | NonModHist | Max | 0.02 | 8.01 | 15.31 |
| 11 | A5 | NonModHist | Max | 39.72 | 0.00 | 8.98 |
| 12 | A5 | NonModHist | Max | 35.38 | 0.00 | 7.52 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | A5 | NonModHist | Max | 41.49 | 0.00 | 4.81 |
| 15 | A5 | NonModHist | Max | 0.00 | 0.00 | 14.89 |
| 16 | A5 | NonModHist | Max | 0.00 | 0.00 | 8.81 |
| 17 | A5 | NonModHist | Max | 0.00 | 0.00 | 9.94 |
| 500 | A5 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| 600 | A5 | NonModHist | Max | 0.00 | 0.00 | 0.00 |
| | **A5** | **Max** | **SUM:** | **170.63** | **16.02** | **77.69** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A5 | NonModHist | Min | -55.92 | -8.01 | -9.54 |
| 2 | A5 | NonModHist | Min | -0.03 | -8.01 | -16.54 |
| 11 | A5 | NonModHist | Min | -53.31 | 0.00 | -8.15 |
| 12 | A5 | NonModHist | Min | -41.47 | 0.00 | -6.13 |
| 13 | A5 | NonModHist | Min | -59.17 | 0.00 | -5.31 |
| 15 | A5 | NonModHist | Min | 0.00 | 0.00 | -13.27 |
| 16 | A5 | NonModHist | Min | 0.00 | 0.00 | -10.52 |
| 17 | A5 | NonModHist | Min | 0.00 | 0.00 | -11.37 |
| 500 | A5 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| 600 | A5 | NonModHist | Min | 0.00 | 0.00 | 0.00 |
| | **A5** | **Min** | **SUM:** | **-209.90** | **-16.03** | **-80.83** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C15 | Combination | Max | 53.91 | 8.01 | 25.64 |
| 2 | C15 | Combination | Max | 0.03 | 8.01 | 63.29 |
| 11 | C15 | Combination | Max | 47.43 | 0.00 | 27.43 |
| 12 | C15 | Combination | Max | 42.55 | 0.00 | 24.02 |
| 13 | C15 | Combination | Max | 48.46 | 0.00 | 21.22 |
| 15 | C15 | Combination | Max | 0.00 | 0.00 | 61.87 |
| 16 | C15 | Combination | Max | 0.00 | 0.00 | 54.69 |
| 17 | C15 | Combination | Max | 0.00 | 0.00 | 55.86 |
| 500 | C15 | Combination | Max | 0.00 | 0.00 | 0.00 |
| 600 | C15 | Combination | Max | 0.00 | 0.00 | 0.00 |
| | **C15** | **Max** | **SUM:** | **192.38** | **16.02** | **334.01** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | C15 | Combination | Min | -53.99 | -8.01 | 7.07 |
| 2 | C15 | Combination | Min | -0.03 | -8.01 | 28.39 |
| 11 | C15 | Combination | Min | -47.28 | 0.00 | 8.16 |
| 12 | C15 | Combination | Min | -42.79 | 0.00 | 9.61 |
| 13 | C15 | Combination | Min | -48.30 | 0.00 | 9.52 |
| 15 | C15 | Combination | Min | 0.00 | 0.00 | 31.15 |
| 16 | C15 | Combination | Min | 0.00 | 0.00 | 35.30 |
| 17 | C15 | Combination | Min | 0.00 | 0.00 | 32.79 |
| 500 | C15 | Combination | Min | 0.00 | 0.00 | 0.00 |
| 600 | C15 | Combination | Min | 0.00 | 0.00 | 0.00 |
| | **C15** | **Min** | **SUM:** | **-192.38** | **-16.02** | **161.99** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | DL | LinStatic | | -0.05 | 0.00 | 15.39 |
| 2 | DL | LinStatic | | 0.00 | 0.00 | 39.28 |
| 11 | DL | LinStatic | | 0.08 | 0.00 | 16.83 |
| 12 | DL | LinStatic | | -0.11 | 0.00 | 15.85 |
| 13 | DL | LinStatic | | 0.07 | 0.00 | 14.41 |
| 15 | DL | LinStatic | | 0.00 | 0.00 | 40.00 |
| 16 | DL | LinStatic | | 0.00 | 0.00 | 38.49 |
| 17 | DL | LinStatic | | 0.00 | 0.00 | 37.76 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | DL | LinStatic | | 0.00 | 0.00 | 0.00 |
| 600 | DL | LinStatic | | 0.00 | 0.00 | 0.00 |
| | **DL** | **0** | **SUM:** | **0.00** | **0.00** | **218.00** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Max | 53.95 | 8.01 | 9.28 |
| 2 | EQ | Combination | Max | 0.03 | 8.01 | 17.45 |
| 11 | EQ | Combination | Max | 47.36 | 0.00 | 9.63 |
| 12 | EQ | Combination | Max | 42.67 | 0.00 | 7.20 |
| 13 | EQ | Combination | Max | 48.38 | 0.00 | 5.85 |
| 15 | EQ | Combination | Max | 0.00 | 0.00 | 15.36 |
| 16 | EQ | Combination | Max | 0.00 | 0.00 | 9.70 |
| 17 | EQ | Combination | Max | 0.00 | 0.00 | 11.54 |
| 500 | EQ | Combination | Max | 0.00 | 0.00 | 0.00 |
| 600 | EQ | Combination | Max | 0.00 | 0.00 | 0.00 |
| | **EQ** | **Max** | **SUM:** | **192.38** | **16.02** | **86.01** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | EQ | Combination | Min | -53.95 | -8.01 | -9.28 |
| 2 | EQ | Combination | Min | -0.03 | -8.01 | -17.45 |
| 11 | EQ | Combination | Min | -47.36 | 0.00 | -9.63 |
| 12 | EQ | Combination | Min | -42.67 | 0.00 | -7.20 |
| 13 | EQ | Combination | Min | -48.38 | 0.00 | -5.85 |
| 15 | EQ | Combination | Min | 0.00 | 0.00 | -15.36 |
| 16 | EQ | Combination | Min | 0.00 | 0.00 | -9.70 |
| 17 | EQ | Combination | Min | 0.00 | 0.00 | -11.54 |
| 500 | EQ | Combination | Min | 0.00 | 0.00 | 0.00 |
| 600 | EQ | Combination | Min | 0.00 | 0.00 | 0.00 |
| | **EQ** | **Min** | **SUM:** | **-192.38** | **-16.02** | **-86.01** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | LL | LinStatic | | 0.01 | 0.00 | 0.96 |
| 2 | LL | LinStatic | | 0.00 | 0.00 | 6.57 |
| 11 | LL | LinStatic | | -0.01 | 0.00 | 0.96 |
| 12 | LL | LinStatic | | -0.01 | 0.00 | 0.96 |
| 13 | LL | LinStatic | | 0.01 | 0.00 | 0.96 |
| 15 | LL | LinStatic | | 0.00 | 0.00 | 6.51 |
| 16 | LL | LinStatic | | 0.00 | 0.00 | 6.51 |
| 17 | LL | LinStatic | | 0.00 | 0.00 | 6.57 |
| 500 | LL | LinStatic | | 0.00 | 0.00 | 0.00 |
| 600 | LL | LinStatic | | 0.00 | 0.00 | 0.00 |
| | **LL** | **0** | **SUM:** | **0.00** | **0.00** | **30.00** |

## CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT H
## MODAL INFORMATION
## (FREQUENCIES AND MASS PARTICIPATION)
### Tabularized Selected Output

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## Case-01

| Case-01: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.20 | 5.03 | 0.75 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| 2 | 0.26 | 3.87 | 0.00 | 0.87 | 0.00 | 0.75 | 0.87 | 0.00 |
| 3 | 0.37 | 2.71 | 0.00 | 0.00 | 0.00 | 0.75 | 0.87 | 0.00 |
| 4 | 0.37 | 2.71 | 0.00 | 0.00 | 0.00 | 0.75 | 0.87 | 0.00 |
| 5 | 0.68 | 1.46 | 0.00 | 0.13 | 0.00 | 0.75 | 1.00 | 0.00 |
| 6 | 0.75 | 1.33 | 0.02 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 7 | 1.91 | 0.52 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 8 | 3.31 | 0.30 | 0.00 | 0.00 | 0.90 | 0.77 | 1.00 | 0.90 |
| 9 | 4.73 | 0.21 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.90 |
| 10 | 14.75 | 0.07 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.90 |
| 11 | 15.53 | 0.06 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 12 | 17.60 | 0.06 | 0.01 | 0.00 | 0.00 | 0.78 | 1.00 | 0.91 |
| 13 | 18.35 | 0.05 | 0.21 | 0.00 | 0.00 | 0.99 | 1.00 | 0.91 |
| 14 | 22.05 | 0.05 | 0.01 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 15 | 29.88 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 16 | 36.42 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.92 |
| 17 | 38.97 | 0.03 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.93 |
| 18 | 50.78 | 0.02 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 19 | 85.52 | 0.01 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 20 | 123.79 | 0.01 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |

## Case-02

| Case-02: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.20 | 5.03 | 0.75 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| 2 | 0.26 | 3.91 | 0.00 | 0.87 | 0.00 | 0.75 | 0.87 | 0.00 |
| 3 | 0.37 | 2.71 | 0.00 | 0.00 | 0.00 | 0.75 | 0.87 | 0.00 |
| 4 | 0.37 | 2.71 | 0.00 | 0.00 | 0.00 | 0.75 | 0.87 | 0.00 |
| 5 | 0.69 | 1.46 | 0.00 | 0.13 | 0.00 | 0.75 | 1.00 | 0.00 |
| 6 | 0.75 | 1.33 | 0.02 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 7 | 1.65 | 0.61 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 8 | 4.48 | 0.22 | 0.00 | 0.00 | 0.91 | 0.77 | 1.00 | 0.91 |
| 9 | 6.51 | 0.15 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 10 | 8.92 | 0.11 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 11 | 11.56 | 0.09 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 12 | 14.71 | 0.07 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 13 | 17.89 | 0.06 | 0.04 | 0.00 | 0.00 | 0.81 | 1.00 | 0.91 |
| 14 | 18.48 | 0.05 | 0.18 | 0.00 | 0.00 | 0.99 | 1.00 | 0.91 |
| 15 | 27.36 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.91 |
| 16 | 29.85 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 17 | 41.76 | 0.02 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.93 |
| 18 | 50.83 | 0.02 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 19 | 60.58 | 0.02 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 20 | 116.12 | 0.01 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |

## Case-03

| Case-03: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.20 | 5.03 | 0.75 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| 2 | 0.25 | 3.96 | 0.00 | 0.86 | 0.00 | 0.75 | 0.86 | 0.00 |
| 3 | 0.37 | 2.71 | 0.00 | 0.00 | 0.00 | 0.75 | 0.86 | 0.00 |
| 4 | 0.37 | 2.71 | 0.00 | 0.00 | 0.00 | 0.75 | 0.86 | 0.00 |
| 5 | 0.69 | 1.46 | 0.00 | 0.13 | 0.00 | 0.75 | 1.00 | 0.00 |
| 6 | 0.75 | 1.33 | 0.02 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 7 | 1.50 | 0.67 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 8 | 5.85 | 0.17 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 9 | 6.31 | 0.16 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 10 | 7.09 | 0.14 | 0.00 | 0.00 | 0.86 | 0.77 | 1.00 | 0.86 |
| 11 | 12.11 | 0.08 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.86 |
| 12 | 14.67 | 0.07 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.86 |
| 13 | 17.64 | 0.06 | 0.02 | 0.00 | 0.00 | 0.79 | 1.00 | 0.86 |
| 14 | 18.45 | 0.05 | 0.20 | 0.00 | 0.00 | 0.99 | 1.00 | 0.86 |
| 15 | 25.79 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.86 |
| 16 | 30.45 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.86 |
| 17 | 35.52 | 0.03 | 0.00 | 0.00 | 0.04 | 1.00 | 1.00 | 0.89 |
| 18 | 42.55 | 0.02 | 0.00 | 0.00 | 0.03 | 1.00 | 1.00 | 0.92 |
| 19 | 111.12 | 0.01 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.93 |
| 20 | 132.94 | 0.01 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.93 |

## Case-04

| Case-04: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.32 | 3.10 | 0.18 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 |
| 2 | 0.34 | 2.98 | 0.00 | 0.12 | 0.00 | 0.18 | 0.12 | 0.00 |
| 3 | 0.36 | 2.74 | 0.02 | 0.00 | 0.00 | 0.20 | 0.12 | 0.00 |
| 4 | 0.37 | 2.72 | 0.00 | 0.02 | 0.00 | 0.20 | 0.14 | 0.00 |
| 5 | 0.47 | 2.14 | 0.31 | 0.00 | 0.00 | 0.51 | 0.14 | 0.00 |
| 6 | 0.53 | 1.89 | 0.00 | 0.86 | 0.00 | 0.51 | 1.00 | 0.00 |
| 7 | 1.91 | 0.52 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.00 |
| 8 | 4.72 | 0.21 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.00 |
| 9 | 5.54 | 0.18 | 0.00 | 0.00 | 0.81 | 0.51 | 1.00 | 0.81 |
| 10 | 11.05 | 0.09 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.81 |
| 11 | 14.75 | 0.07 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.81 |
| 12 | 18.11 | 0.06 | 0.21 | 0.00 | 0.00 | 0.72 | 1.00 | 0.81 |
| 13 | 18.51 | 0.05 | 0.26 | 0.00 | 0.00 | 0.98 | 1.00 | 0.81 |
| 14 | 22.79 | 0.04 | 0.01 | 0.00 | 0.00 | 0.99 | 1.00 | 0.81 |
| 15 | 32.30 | 0.03 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.81 |
| 16 | 38.76 | 0.03 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.81 |
| 17 | 44.37 | 0.02 | 0.00 | 0.00 | 0.04 | 0.99 | 1.00 | 0.85 |
| 18 | 50.95 | 0.02 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.85 |
| 19 | 85.66 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.85 |
| 20 | 127.26 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.85 |

## Case-05

| Case-05: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.32 | 3.10 | 0.18 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 |
| 2 | 0.34 | 2.98 | 0.00 | 0.12 | 0.00 | 0.18 | 0.12 | 0.00 |
| 3 | 0.36 | 2.74 | 0.02 | 0.00 | 0.00 | 0.20 | 0.12 | 0.00 |
| 4 | 0.37 | 2.72 | 0.00 | 0.02 | 0.00 | 0.20 | 0.14 | 0.00 |
| 5 | 0.47 | 2.14 | 0.31 | 0.00 | 0.00 | 0.51 | 0.14 | 0.00 |
| 6 | 0.53 | 1.89 | 0.00 | 0.85 | 0.00 | 0.51 | 1.00 | 0.00 |
| 7 | 1.63 | 0.61 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.00 |
| 8 | 6.51 | 0.15 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.00 |
| 9 | 7.07 | 0.14 | 0.00 | 0.00 | 0.81 | 0.51 | 1.00 | 0.81 |
| 10 | 9.50 | 0.11 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.81 |
| 11 | 11.56 | 0.09 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.81 |
| 12 | 16.08 | 0.06 | 0.00 | 0.00 | 0.00 | 0.52 | 1.00 | 0.81 |
| 13 | 18.37 | 0.05 | 0.47 | 0.00 | 0.00 | 0.99 | 1.00 | 0.81 |
| 14 | 22.56 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.81 |
| 15 | 27.80 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.81 |
| 16 | 39.21 | 0.03 | 0.00 | 0.00 | 0.02 | 0.99 | 1.00 | 0.84 |
| 17 | 45.45 | 0.02 | 0.00 | 0.00 | 0.01 | 0.99 | 1.00 | 0.84 |
| 18 | 50.61 | 0.02 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.85 |
| 19 | 60.74 | 0.02 | 0.00 | 0.00 | 0.01 | 0.99 | 1.00 | 0.86 |
| 20 | 164.85 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.86 |

## Case-06

| Case-06: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.32 | 3.10 | 0.18 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 |
| 2 | 0.34 | 2.98 | 0.00 | 0.12 | 0.00 | 0.18 | 0.12 | 0.00 |
| 3 | 0.36 | 2.74 | 0.02 | 0.00 | 0.00 | 0.20 | 0.12 | 0.00 |
| 4 | 0.37 | 2.73 | 0.00 | 0.02 | 0.00 | 0.20 | 0.15 | 0.00 |
| 5 | 0.47 | 2.14 | 0.31 | 0.00 | 0.00 | 0.51 | 0.15 | 0.00 |
| 6 | 0.53 | 1.90 | 0.00 | 0.85 | 0.00 | 0.51 | 0.99 | 0.00 |
| 7 | 1.48 | 0.68 | 0.00 | 0.01 | 0.00 | 0.51 | 1.00 | 0.00 |
| 8 | 5.68 | 0.18 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.00 |
| 9 | 6.28 | 0.16 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.00 |
| 10 | 9.43 | 0.11 | 0.00 | 0.00 | 0.64 | 0.51 | 1.00 | 0.64 |
| 11 | 14.66 | 0.07 | 0.00 | 0.00 | 0.00 | 0.51 | 1.00 | 0.64 |
| 12 | 16.89 | 0.06 | 0.00 | 0.00 | 0.00 | 0.52 | 1.00 | 0.64 |
| 13 | 18.35 | 0.05 | 0.46 | 0.00 | 0.00 | 0.98 | 1.00 | 0.64 |
| 14 | 22.60 | 0.04 | 0.01 | 0.00 | 0.01 | 0.99 | 1.00 | 0.65 |
| 15 | 25.99 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.65 |
| 16 | 34.14 | 0.03 | 0.00 | 0.00 | 0.13 | 0.99 | 1.00 | 0.78 |
| 17 | 43.80 | 0.02 | 0.00 | 0.00 | 0.03 | 0.99 | 1.00 | 0.81 |
| 18 | 50.47 | 0.02 | 0.00 | 0.00 | 0.03 | 0.99 | 1.00 | 0.84 |
| 19 | 112.35 | 0.01 | 0.00 | 0.00 | 0.03 | 0.99 | 1.00 | 0.87 |
| 20 | 170.56 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |

## Case-07

| Case-07: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.10 | 10.11 | 0.61 | 0.00 | 0.00 | 0.61 | 0.00 | 0.00 |
| 2 | 0.10 | 9.66 | 0.00 | 0.60 | 0.00 | 0.61 | 0.60 | 0.00 |
| 3 | 0.36 | 2.75 | 0.02 | 0.00 | 0.00 | 0.63 | 0.60 | 0.00 |
| 4 | 0.37 | 2.73 | 0.00 | 0.01 | 0.00 | 0.63 | 0.61 | 0.00 |
| 5 | 0.48 | 2.09 | 0.15 | 0.00 | 0.00 | 0.77 | 0.61 | 0.00 |
| 6 | 0.54 | 1.87 | 0.00 | 0.39 | 0.00 | 0.77 | 1.00 | 0.00 |
| 7 | 1.91 | 0.52 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 8 | 2.38 | 0.42 | 0.00 | 0.00 | 0.77 | 0.77 | 1.00 | 0.77 |
| 9 | 4.72 | 0.21 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.77 |
| 10 | 7.15 | 0.14 | 0.00 | 0.00 | 0.14 | 0.77 | 1.00 | 0.91 |
| 11 | 14.75 | 0.07 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 12 | 17.38 | 0.06 | 0.00 | 0.00 | 0.00 | 0.78 | 1.00 | 0.91 |
| 13 | 18.34 | 0.05 | 0.21 | 0.00 | 0.00 | 0.99 | 1.00 | 0.91 |
| 14 | 21.96 | 0.05 | 0.01 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 15 | 31.27 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 16 | 35.33 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 17 | 41.92 | 0.02 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.93 |
| 18 | 50.59 | 0.02 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 19 | 85.66 | 0.01 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 20 | 120.45 | 0.01 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |

## Case-08

| Case-08: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.10 | 10.11 | 0.61 | 0.00 | 0.00 | 0.61 | 0.00 | 0.00 |
| 2 | 0.10 | 9.68 | 0.00 | 0.60 | 0.00 | 0.61 | 0.60 | 0.00 |
| 3 | 0.36 | 2.75 | 0.02 | 0.00 | 0.00 | 0.63 | 0.60 | 0.00 |
| 4 | 0.37 | 2.73 | 0.00 | 0.01 | 0.00 | 0.63 | 0.61 | 0.00 |
| 5 | 0.48 | 2.09 | 0.15 | 0.00 | 0.00 | 0.77 | 0.61 | 0.00 |
| 6 | 0.53 | 1.87 | 0.00 | 0.39 | 0.00 | 0.77 | 1.00 | 0.00 |
| 7 | 1.63 | 0.61 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 8 | 2.68 | 0.37 | 0.00 | 0.00 | 0.70 | 0.77 | 1.00 | 0.70 |
| 9 | 6.51 | 0.15 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.70 |
| 10 | 8.03 | 0.12 | 0.00 | 0.00 | 0.21 | 0.77 | 1.00 | 0.91 |
| 11 | 9.84 | 0.10 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 12 | 11.75 | 0.09 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.91 |
| 13 | 18.16 | 0.06 | 0.09 | 0.00 | 0.00 | 0.87 | 1.00 | 0.91 |
| 14 | 18.53 | 0.05 | 0.13 | 0.00 | 0.00 | 0.99 | 1.00 | 0.91 |
| 15 | 27.60 | 0.04 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 16 | 29.26 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.91 |
| 17 | 40.22 | 0.02 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.93 |
| 18 | 48.50 | 0.02 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 19 | 50.69 | 0.02 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |
| 20 | 136.39 | 0.01 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.93 |

## Case-09

| Case-09: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.10 | 10.11 | 0.61 | 0.00 | 0.00 | 0.61 | 0.00 | 0.00 |
| 2 | 0.10 | 9.69 | 0.00 | 0.60 | 0.00 | 0.61 | 0.60 | 0.00 |
| 3 | 0.36 | 2.75 | 0.02 | 0.00 | 0.00 | 0.63 | 0.60 | 0.00 |
| 4 | 0.37 | 2.73 | 0.00 | 0.01 | 0.00 | 0.63 | 0.61 | 0.00 |
| 5 | 0.48 | 2.09 | 0.15 | 0.00 | 0.00 | 0.77 | 0.61 | 0.00 |
| 6 | 0.53 | 1.88 | 0.00 | 0.38 | 0.00 | 0.77 | 1.00 | 0.00 |
| 7 | 1.48 | 0.68 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.00 |
| 8 | 2.93 | 0.34 | 0.00 | 0.00 | 0.60 | 0.77 | 1.00 | 0.60 |
| 9 | 5.74 | 0.17 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.60 |
| 10 | 6.30 | 0.16 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.60 |
| 11 | 9.64 | 0.10 | 0.00 | 0.00 | 0.24 | 0.77 | 1.00 | 0.84 |
| 12 | 14.74 | 0.07 | 0.00 | 0.00 | 0.00 | 0.77 | 1.00 | 0.84 |
| 13 | 18.27 | 0.05 | 0.20 | 0.00 | 0.00 | 0.97 | 1.00 | 0.84 |
| 14 | 19.29 | 0.05 | 0.02 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 15 | 25.66 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 16 | 27.81 | 0.04 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.85 |
| 17 | 36.96 | 0.03 | 0.00 | 0.00 | 0.06 | 1.00 | 1.00 | 0.91 |
| 18 | 48.74 | 0.02 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.92 |
| 19 | 89.20 | 0.01 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.92 |
| 20 | 126.65 | 0.01 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.93 |

## Case-10

| Case-10: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.30 | 3.38 | 0.42 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| 2 | 0.33 | 3.03 | 0.00 | 0.32 | 0.00 | 0.42 | 0.32 | 0.00 |
| 3 | 0.35 | 2.88 | 0.01 | 0.00 | 0.00 | 0.43 | 0.32 | 0.00 |
| 4 | 0.35 | 2.84 | 0.00 | 0.12 | 0.00 | 0.43 | 0.44 | 0.00 |
| 5 | 0.54 | 1.86 | 0.14 | 0.00 | 0.00 | 0.57 | 0.44 | 0.00 |
| 6 | 0.56 | 1.78 | 0.00 | 0.56 | 0.00 | 0.57 | 1.00 | 0.00 |
| 7 | 1.91 | 0.52 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 8 | 4.72 | 0.21 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 9 | 5.00 | 0.20 | 0.00 | 0.00 | 0.83 | 0.57 | 1.00 | 0.83 |
| 10 | 14.75 | 0.07 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.83 |
| 11 | 16.08 | 0.06 | 0.00 | 0.00 | 0.01 | 0.57 | 1.00 | 0.83 |
| 12 | 17.47 | 0.06 | 0.01 | 0.00 | 0.00 | 0.58 | 1.00 | 0.83 |
| 13 | 18.35 | 0.05 | 0.40 | 0.00 | 0.00 | 0.98 | 1.00 | 0.83 |
| 14 | 22.31 | 0.04 | 0.01 | 0.00 | 0.00 | 0.99 | 1.00 | 0.83 |
| 15 | 30.75 | 0.03 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.83 |
| 16 | 39.06 | 0.03 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 17 | 46.06 | 0.02 | 0.00 | 0.00 | 0.03 | 0.99 | 1.00 | 0.87 |
| 18 | 50.79 | 0.02 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |
| 19 | 85.72 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |
| 20 | 129.35 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |

## Case-11

| Case-11: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.30 | 3.38 | 0.42 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| 2 | 0.33 | 3.03 | 0.00 | 0.33 | 0.00 | 0.42 | 0.33 | 0.00 |
| 3 | 0.35 | 2.88 | 0.01 | 0.00 | 0.00 | 0.43 | 0.33 | 0.00 |
| 4 | 0.35 | 2.84 | 0.00 | 0.12 | 0.00 | 0.43 | 0.44 | 0.00 |
| 5 | 0.54 | 1.86 | 0.14 | 0.00 | 0.00 | 0.57 | 0.44 | 0.00 |
| 6 | 0.56 | 1.78 | 0.00 | 0.55 | 0.00 | 0.57 | 1.00 | 0.00 |
| 7 | 1.63 | 0.61 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 8 | 6.33 | 0.16 | 0.00 | 0.00 | 0.83 | 0.57 | 1.00 | 0.83 |
| 9 | 6.51 | 0.15 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.83 |
| 10 | 9.46 | 0.11 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.83 |
| 11 | 11.63 | 0.09 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.83 |
| 12 | 16.27 | 0.06 | 0.00 | 0.00 | 0.01 | 0.57 | 1.00 | 0.84 |
| 13 | 17.84 | 0.06 | 0.06 | 0.00 | 0.00 | 0.63 | 1.00 | 0.84 |
| 14 | 18.45 | 0.05 | 0.36 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 15 | 27.54 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 16 | 30.15 | 0.03 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 17 | 38.98 | 0.03 | 0.00 | 0.00 | 0.02 | 0.99 | 1.00 | 0.86 |
| 18 | 50.61 | 0.02 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.86 |
| 19 | 55.78 | 0.02 | 0.00 | 0.00 | 0.01 | 0.99 | 1.00 | 0.87 |
| 20 | 131.16 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.88 |

## Case-12

| Case-12: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.30 | 3.38 | 0.42 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| 2 | 0.33 | 3.04 | 0.00 | 0.34 | 0.00 | 0.42 | 0.34 | 0.00 |
| 3 | 0.35 | 2.88 | 0.01 | 0.00 | 0.00 | 0.43 | 0.34 | 0.00 |
| 4 | 0.35 | 2.85 | 0.00 | 0.11 | 0.00 | 0.43 | 0.45 | 0.00 |
| 5 | 0.54 | 1.86 | 0.14 | 0.00 | 0.00 | 0.57 | 0.45 | 0.00 |
| 6 | 0.56 | 1.79 | 0.00 | 0.55 | 0.00 | 0.57 | 0.99 | 0.00 |
| 7 | 1.48 | 0.68 | 0.00 | 0.01 | 0.00 | 0.57 | 1.00 | 0.00 |
| 8 | 5.93 | 0.17 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 9 | 6.33 | 0.16 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 10 | 8.73 | 0.11 | 0.00 | 0.00 | 0.69 | 0.57 | 1.00 | 0.69 |
| 11 | 14.67 | 0.07 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.69 |
| 12 | 15.62 | 0.06 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.69 |
| 13 | 17.53 | 0.06 | 0.03 | 0.00 | 0.00 | 0.60 | 1.00 | 0.69 |
| 14 | 18.44 | 0.05 | 0.39 | 0.00 | 0.00 | 0.99 | 1.00 | 0.69 |
| 15 | 25.78 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.69 |
| 16 | 30.95 | 0.03 | 0.00 | 0.00 | 0.02 | 0.99 | 1.00 | 0.71 |
| 17 | 34.45 | 0.03 | 0.00 | 0.00 | 0.09 | 0.99 | 1.00 | 0.80 |
| 18 | 41.66 | 0.02 | 0.00 | 0.00 | 0.04 | 0.99 | 1.00 | 0.85 |
| 19 | 109.65 | 0.01 | 0.00 | 0.00 | 0.01 | 0.99 | 1.00 | 0.86 |
| 20 | 139.63 | 0.01 | 0.00 | 0.00 | 0.01 | 1.00 | 1.00 | 0.87 |

## Case-13

| Case-13: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No: | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.11 | 9.38 | 0.15 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 |
| 2 | 0.11 | 9.32 | 0.00 | 0.14 | 0.00 | 0.15 | 0.14 | 0.00 |
| 3 | 0.33 | 3.08 | 0.13 | 0.00 | 0.00 | 0.28 | 0.14 | 0.00 |
| 4 | 0.34 | 2.97 | 0.00 | 0.09 | 0.00 | 0.28 | 0.23 | 0.00 |
| 5 | 0.46 | 2.16 | 0.29 | 0.00 | 0.00 | 0.57 | 0.23 | 0.00 |
| 6 | 0.53 | 1.89 | 0.00 | 0.77 | 0.00 | 0.57 | 1.00 | 0.00 |
| 7 | 1.91 | 0.52 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 8 | 3.83 | 0.26 | 0.00 | 0.00 | 0.43 | 0.57 | 1.00 | 0.43 |
| 9 | 4.72 | 0.21 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.43 |
| 10 | 6.20 | 0.16 | 0.00 | 0.00 | 0.41 | 0.57 | 1.00 | 0.83 |
| 11 | 14.75 | 0.07 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.83 |
| 12 | 16.89 | 0.06 | 0.00 | 0.00 | 0.00 | 0.58 | 1.00 | 0.83 |
| 13 | 18.32 | 0.05 | 0.40 | 0.00 | 0.00 | 0.98 | 1.00 | 0.83 |
| 14 | 21.95 | 0.05 | 0.01 | 0.00 | 0.00 | 0.99 | 1.00 | 0.83 |
| 15 | 31.52 | 0.03 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 16 | 35.70 | 0.03 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 17 | 42.57 | 0.02 | 0.00 | 0.00 | 0.03 | 0.99 | 1.00 | 0.87 |
| 18 | 50.09 | 0.02 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |
| 19 | 84.47 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |
| 20 | 114.23 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |

## Case-14

| Case-14: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No: | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.11 | 9.38 | 0.15 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 |
| 2 | 0.11 | 9.32 | 0.00 | 0.14 | 0.00 | 0.15 | 0.14 | 0.00 |
| 3 | 0.33 | 3.08 | 0.13 | 0.00 | 0.00 | 0.28 | 0.14 | 0.00 |
| 4 | 0.34 | 2.98 | 0.00 | 0.09 | 0.00 | 0.28 | 0.24 | 0.00 |
| 5 | 0.46 | 2.16 | 0.29 | 0.00 | 0.00 | 0.57 | 0.24 | 0.00 |
| 6 | 0.53 | 1.90 | 0.00 | 0.76 | 0.00 | 0.57 | 1.00 | 0.00 |
| 7 | 1.63 | 0.61 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 8 | 4.04 | 0.25 | 0.00 | 0.00 | 0.28 | 0.57 | 1.00 | 0.28 |
| 9 | 6.51 | 0.15 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.28 |
| 10 | 7.51 | 0.13 | 0.00 | 0.00 | 0.55 | 0.57 | 1.00 | 0.84 |
| 11 | 10.20 | 0.10 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.84 |
| 12 | 11.77 | 0.08 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.84 |
| 13 | 17.88 | 0.06 | 0.04 | 0.00 | 0.00 | 0.61 | 1.00 | 0.84 |
| 14 | 18.42 | 0.05 | 0.37 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 15 | 26.72 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 16 | 28.39 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 17 | 39.74 | 0.03 | 0.00 | 0.00 | 0.02 | 0.99 | 1.00 | 0.86 |
| 18 | 47.80 | 0.02 | 0.00 | 0.00 | 0.01 | 0.99 | 1.00 | 0.87 |
| 19 | 55.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |
| 20 | 126.06 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.87 |

**Case-15**

| Case-15: Modal Participating Mass Ratios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Freq. | Period | UX | UY | UZ | SumUX | SumUY | SumUZ |
| No. | Hz | Sec | Unitless | Unitless | Unitless | Unitless | Unitless | Unitless |
| 1 | 0.11 | 9.38 | 0.15 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 |
| 2 | 0.11 | 9.33 | 0.00 | 0.14 | 0.00 | 0.15 | 0.14 | 0.00 |
| 3 | 0.33 | 3.08 | 0.13 | 0.00 | 0.00 | 0.28 | 0.14 | 0.00 |
| 4 | 0.34 | 2.98 | 0.00 | 0.10 | 0.00 | 0.28 | 0.24 | 0.00 |
| 5 | 0.46 | 2.16 | 0.29 | 0.00 | 0.00 | 0.57 | 0.24 | 0.00 |
| 6 | 0.52 | 1.91 | 0.00 | 0.76 | 0.00 | 0.57 | 0.99 | 0.00 |
| 7 | 1.48 | 0.68 | 0.00 | 0.01 | 0.00 | 0.57 | 1.00 | 0.00 |
| 8 | 5.89 | 0.17 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 9 | 6.32 | 0.16 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.00 |
| 10 | 8.73 | 0.11 | 0.00 | 0.00 | 0.69 | 0.57 | 1.00 | 0.69 |
| 11 | 14.64 | 0.07 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.69 |
| 12 | 15.57 | 0.06 | 0.00 | 0.00 | 0.00 | 0.57 | 1.00 | 0.69 |
| 13 | 17.81 | 0.06 | 0.04 | 0.00 | 0.00 | 0.62 | 1.00 | 0.69 |
| 14 | 18.43 | 0.05 | 0.37 | 0.00 | 0.00 | 0.99 | 1.00 | 0.69 |
| 15 | 24.34 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.69 |
| 16 | 27.93 | 0.04 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.70 |
| 17 | 35.73 | 0.03 | 0.00 | 0.00 | 0.14 | 0.99 | 1.00 | 0.84 |
| 18 | 44.51 | 0.02 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 19 | 99.64 | 0.01 | 0.00 | 0.00 | 0.00 | 0.99 | 1.00 | 0.84 |
| 20 | 131.46 | 0.01 | 0.00 | 0.00 | 0.03 | 0.99 | 1.00 | 0.87 |

**CAL-20776-SE-007**

**NON-LINEAR SEISMIC TIME HISTORY ANALYSIS**

**ATTACHMENT I**

**SAP2000 ANALYSIS INPUT TEXT FILES (.s2k Files)**

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## Case-01

```
CASE01 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT MID-SPAN
;MH HOOK UP WITH LOAD
;AH HOOK UP NO LOAD
;FILE: Case01.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=604.5   Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=844     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=604.5   Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=844     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=458.5  Y=-120    Z=56.25
402    X=458.5  Y=120     Z=56.25
701    X=458.5  Y=-120    Z=56.25
702    X=458.5  Y=120     Z=56.25
703    X=604.5  Y=-120    Z=56.25
704    X=604.5  Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=458.5  Y=-120      Z=81
302   X=458.5  Y=120       Z=81
303   X=604.5  Y=-120      Z=81
304    X=604.5  Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=531.5  Y=0       Z=81 ;MAIN HOIST
601   X=477.5  Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=531.5  Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=477.5  Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=250+8/386.1        UY=250+8/386.1        UZ=250+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=250+8/84 ;(W/L)
  DOF=U3   KE=250+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10        NLP=BR1
 BR2    J=2,14        NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000  I=162787,8558
  NAME=WG MAT=WG A=109  J=24000  I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720   I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6    I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01  J=301,601   SEC=RG
 R02  J=302,601
 R03  J=303,501
 R04  J=304,501
 R05  J=601,501
;TROLLEY WHEELS
 RT1  J=104,701   SEC=RG
 RT2  J=204,702
 RT3  J=106,703
 RT4  J=206,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-250
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C01
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-02

```
CASE02 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT QUARTER-SPAN
;MH HOOK UP WITH LOAD
;AH HOOK UP NO LOAD
;FILE: Case02.s2k
;TWO JOINT DRIVE WHEEL SUPPORT
SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120     Z=0
102    X=146     Y=-120     Z=0
103    X=284     Y=-120     Z=0
104    X=458.5   Y=-120     Z=0
105    X=495     Y=-120     Z=0
106    X=633     Y=-120     Z=0
107    X=706     Y=-120     Z=0
108    X=852     Y=-120     Z=0
109    X=990     Y=-120     Z=0
;WEST IDLER GIRDER
201    X=0       Y=120      Z=0
202    X=146     Y=120      Z=0
203    X=284     Y=120      Z=0
204    X=458.5   Y=120      Z=0
205    X=495     Y=120      Z=0
206    X=633     Y=120      Z=0
207    X=706     Y=120      Z=0
208    X=852     Y=120      Z=0
209    X=990     Y=120      Z=0
;BRIDGE WHEELS
1      X=0       Y=-156     Z=-1.5
2      X=990     Y=-156     Z=-1.5
10     X=0       Y=-156     Z=-1.5
11     X=0       Y=-84      Z=-1.5
12     X=0       Y=84       Z=-1.5
13     X=0       Y=156      Z=-1.5
14     X=990     Y=-156     Z=-1.5
15     X=990     Y=-84      Z=-1.5
16     X=990     Y=84       Z=-1.5
17     X=990     Y=156      Z=-1.5
;TRUCKS
21     X=0       Y=-156     Z=15
100    X=0       Y=-120     Z=15
22     X=0       Y=-84      Z=15
23     X=0       Y=84       Z=15
200    X=0       Y=120      Z=15
24     X=0       Y=156      Z=15
25     X=990     Y=-156     Z=15
110    X=990     Y=-120     Z=15
26     X=990     Y=-84      Z=15
27     X=990     Y=84       Z=15
210    X=990     Y=120      Z=15
28     X=990     Y=156      Z=15
;END TIES
801   X=0       Y=-120    Z=47
802   X=0       Y=0       Z=47
```

```
803   X=0        Y=120    Z=47
804   X=990      Y=-120   Z=47
805   X=990    Y=0      Z=47
806   X=990      Y=120    Z=47
;TROLLEY WHEELS
401    X=706    Y=-120   Z=56.25
402    X=706    Y=120    Z=56.25
701    X=706    Y=-120   Z=56.25
702    X=706    Y=120    Z=56.25
703    X=852    Y=-120   Z=56.25
704    X=852    Y=120    Z=56.25
;TROLLEY PLATFORM
301    X=706    Y=-120     Z=81
302   X=706    Y=120      Z=81
303   X=852    Y=-120     Z=81
304    X=852    Y=120      Z=81
;TROLLEY HOIST CENTERS
501   X=779    Y=0      Z=81 ;MAIN HOIST
601   X=725    Y=0      Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=779    Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=725    Y=0      Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=250+8/386.1        UY=250+8/386.1        UZ=250+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=250+8/84 ;(W/L)
  DOF=U3   KE=250+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
  DOF=U3   KE=1E6
```

```
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501    NLP=PENDMH
 AHOOK  J=600,601    NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10       NLP=BR1
 BR2    J=2,14       NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1  J=701,401      NLP=TR
 TR2  J=702,402      NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102     SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202     SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100     SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
 TK8  J=210,28
```

```
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
;TROLLEY WHEELS
 RT1  J=107,701   SEC=RG
 RT2  J=207,702
 RT3  J=108,703
 RT4  J=208,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-250
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a3xNS  SF=386.1
```

```
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C02
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-03

```
CASE03 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT END-SPAN
;MH HOOK UP WITH LOAD
;AH HOOK UP NO LOAD
;FILE: Case03.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120     Z=0
102    X=146     Y=-120     Z=0
103    X=284     Y=-120     Z=0
104    X=458.5   Y=-120     Z=0
105    X=495     Y=-120     Z=0
106    X=624.5   Y=-120     Z=0
107    X=706     Y=-120     Z=0
108    X=844     Y=-120     Z=0
109    X=990     Y=-120     Z=0
;WEST IDLER GIRDER
201    X=0       Y=120      Z=0
202    X=146     Y=120      Z=0
203    X=284     Y=120      Z=0
204    X=458.5   Y=120      Z=0
205    X=495     Y=120      Z=0
206    X=624.5   Y=120      Z=0
207    X=706     Y=120      Z=0
208    X=844     Y=120      Z=0
209    X=990     Y=120      Z=0
;BRIDGE WHEELS
1      X=0       Y=-156     Z=-1.5
2      X=990     Y=-156     Z=-1.5
10     X=0       Y=-156     Z=-1.5
11     X=0       Y=-84      Z=-1.5
12     X=0       Y=84       Z=-1.5
13     X=0       Y=156      Z=-1.5
14     X=990     Y=-156     Z=-1.5
15     X=990     Y=-84      Z=-1.5
16     X=990     Y=84       Z=-1.5
17     X=990     Y=156      Z=-1.5
;TRUCKS
21     X=0       Y=-156     Z=15
100    X=0       Y=-120     Z=15
22     X=0       Y=-84      Z=15
23     X=0       Y=84       Z=15
200    X=0       Y=120      Z=15
24     X=0       Y=156      Z=15
25     X=990     Y=-156     Z=15
110    X=990     Y=-120     Z=15
26     X=990     Y=-84      Z=15
27     X=990     Y=84       Z=15
210    X=990     Y=120      Z=15
28     X=990     Y=156      Z=15
;END TIES
801   X=0        Y=-120    Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=844     Y=-120    Z=56.25
402    X=844     Y=120     Z=56.25
701    X=844     Y=-120    Z=56.25
702    X=844     Y=120     Z=56.25
703    X=990     Y=-120    Z=56.25
704    X=990     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=844     Y=-120      Z=81
302   X=844     Y=120       Z=81
303   X=990     Y=-120      Z=81
304    X=990     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=917     Y=0       Z=81 ;MAIN HOIST
601   X=863     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=917     Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=863     Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=250+8/386.1        UY=250+8/386.1        UZ=250+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=250+8/84 ;(W/L)
  DOF=U3   KE=250+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501    NLP=PENDMH
 AHOOK  J=600,601    NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10       NLP=BR1
 BR2    J=2,14       NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401    NLP=TR
 TR2    J=702,402    NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000  I=162787,8558
  NAME=WG MAT=WG A=109  J=24000  I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720   I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6    I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=108,701   SEC=RG
 RT2  J=208,702
 RT3  J=109,703
 RT4  J=209,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-250
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C03
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-04

```
CASE04 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT MID-SPAN
;MH HOOK UP WITH NO LOAD
;AH HOOK UP NO LOAD
;FILE: Case04.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=604.5   Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=844     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=604.5   Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=844     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801    X=0       Y=-120    Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=458.5  Y=-120   Z=56.25
402    X=458.5  Y=120    Z=56.25
701    X=458.5  Y=-120   Z=56.25
702    X=458.5  Y=120    Z=56.25
703    X=604.5  Y=-120   Z=56.25
704    X=604.5  Y=120    Z=56.25
;TROLLEY PLATFORM
301    X=458.5  Y=-120     Z=81
302   X=458.5  Y=120       Z=81
303   X=604.5  Y=-120      Z=81
304    X=604.5  Y=120      Z=81
;TROLLEY HOIST CENTERS
501   X=531.5  Y=0       Z=81 ;MAIN HOIST
601   X=477.5  Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=531.5  Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=477.5  Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR    TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1   TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2   TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501    NLP=PENDMH
 AHOOK  J=600,601    NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10       NLP=BR1
 BR2    J=2,14       NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401    NLP=TR
 TR2    J=702,402    NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01  J=301,601   SEC=RG
 R02  J=302,601
 R03  J=303,501
 R04  J=304,501
 R05  J=601,501
;TROLLEY WHEELS
 RT1  J=104,701   SEC=RG
 RT2  J=204,702
 RT3  J=106,703
 RT4  J=206,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C04
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-05

```
CASE05 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT QUARTER-SPAN
;MH HOOK UP NO LOAD
;AH HOOK UP NO LOAD
;FILE: Case05.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=633     Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=852     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=633     Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=852     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=706     Y=-120    Z=56.25
402    X=706     Y=120     Z=56.25
701    X=706     Y=-120    Z=56.25
702    X=706     Y=120     Z=56.25
703    X=852     Y=-120    Z=56.25
704    X=852     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=706     Y=-120      Z=81
302   X=706     Y=120       Z=81
303   X=852     Y=-120      Z=81
304    X=852     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=779     Y=0       Z=81 ;MAIN HOIST
601   X=725     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=779     Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=725     Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=107,701   SEC=RG
 RT2  J=207,702
 RT3  J=108,703
 RT4  J=208,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C05
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-06

```
CASE06 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT END-SPAN
;MH HOOK UP NO LOAD
;AH HOOK UP NO LOAD
;FILE: Case06.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=624.5   Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=844     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=624.5   Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=844     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=844     Y=-120    Z=56.25
402    X=844     Y=120     Z=56.25
701    X=844     Y=-120    Z=56.25
702    X=844     Y=120     Z=56.25
703    X=990     Y=-120    Z=56.25
704    X=990     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=844     Y=-120      Z=81
302   X=844     Y=120       Z=81
303   X=990     Y=-120      Z=81
304    X=990     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=917     Y=0       Z=81 ;MAIN HOIST
601   X=863     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=917     Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=863     Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1  UY=0+8/386.1  UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1    UY=0+2/386.1    UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=108,701   SEC=RG
 RT2  J=208,702
 RT3  J=109,703
 RT4  J=209,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C06
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-07

```
CASE07 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT MID-SPAN
;MH HOOK DOWN WITH LOAD
;AH HOOK UP NO LOAD
;FILE: Case07.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=604.5   Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=844     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=604.5   Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=844     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=458.5  Y=-120    Z=56.25
402    X=458.5  Y=120     Z=56.25
701    X=458.5  Y=-120    Z=56.25
702    X=458.5  Y=120     Z=56.25
703    X=604.5  Y=-120    Z=56.25
704    X=604.5  Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=458.5  Y=-120      Z=81
302   X=458.5  Y=120       Z=81
303   X=604.5  Y=-120      Z=81
304    X=604.5  Y=120      Z=81
;TROLLEY HOIST CENTERS
501   X=531.5  Y=0       Z=81 ;MAIN HOIST
601   X=477.5  Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=531.5  Y=0  Z=81-864 ;HOOK DOWN L= 72 FT
;AUX HOIST HOOK
600   X=477.5  Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=250+8/386.1        UY=250+8/386.1        UZ=250+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/864 ;(EA/L)
  DOF=U2   KE=250+8/864 ;(W/L)
  DOF=U3   KE=250+8/864 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10        NLP=BR1
 BR2    J=2,14        NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0               ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000  I=162787,8558
  NAME=WG MAT=WG A=109  J=24000  I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720   I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6    I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01  J=301,601   SEC=RG
 R02  J=302,601
 R03  J=303,501
 R04  J=304,501
 R05  J=601,501
 ;TROLLEY WHEELS
 RT1  J=104,701   SEC=RG
 RT2  J=204,702
 RT3  J=106,703
 RT4  J=206,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-250
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C07
  LOAD=DL         SF=1
  LOAD=LL           SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-08

```
CASE08 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT QUARTER-SPAN
;MH HOOK DOWN WITH LOAD
;AH HOOK UP NO LOAD
;FILE: Case08.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=633     Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=852     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=633     Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=852     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=706     Y=-120    Z=56.25
402    X=706     Y=120     Z=56.25
701    X=706     Y=-120    Z=56.25
702    X=706     Y=120     Z=56.25
703    X=852     Y=-120    Z=56.25
704    X=852     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=706     Y=-120      Z=81
302   X=706     Y=120       Z=81
303   X=852     Y=-120      Z=81
304    X=852     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=779     Y=0       Z=81 ;MAIN HOIST
601   X=725     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=779     Y=0  Z=81-864 ;HOOK DOWN L= 72 FT
;AUX HOIST HOOK
600   X=725     Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND BLOCK
  ADD=500  UX=250+8/386.1        UY=250+8/386.1        UZ=250+8/386.1
;AH LIFTED LOAD AND BLOCK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/864 ;(EA/L)
  DOF=U2   KE=250+8/864 ;(W/L)
  DOF=U3   KE=250+8/864 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501     NLP=PENDMH
 AHOOK  J=600,601     NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10        NLP=BR1
 BR2    J=2,14        NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1  J=701,401       NLP=TR
 TR2  J=702,402       NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000  I=162787,8558
  NAME=WG MAT=WG A=109  J=24000  I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720   I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6    I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102     SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202     SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100     SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=107,701   SEC=RG
 RT2  J=207,702
 RT3  J=108,703
 RT4  J=208,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-250
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C08
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-09

```
CASE09 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT END-SPAN
;MH HOOK DOWN WITH LOAD
;AH HOOK UP NO LOAD
;FILE: Case09.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=624.5   Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=844     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=624.5   Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=844     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=844     Y=-120    Z=56.25
402    X=844     Y=120     Z=56.25
701    X=844     Y=-120    Z=56.25
702    X=844     Y=120     Z=56.25
703    X=990     Y=-120    Z=56.25
704    X=990     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=844     Y=-120      Z=81
302   X=844     Y=120       Z=81
303   X=990     Y=-120      Z=81
304    X=990     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=917     Y=0       Z=81 ;MAIN HOIST
601   X=863     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=917     Y=0  Z=81-864 ;HOOK DOWN L= 72 FT
;AUX HOIST HOOK
600   X=863     Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=250+8/386.1        UY=250+8/386.1        UZ=250+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=0+2/386.1          UY=0+2/386.1          UZ=0+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/864 ;(EA/L)
  DOF=U2   KE=250+8/864 ;(W/L)
  DOF=U3   KE=250+8/864 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=0+2/72 ;(W/L)
  DOF=U3   KE=0+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR    TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1   TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2   TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501    NLP=PENDMH
 AHOOK  J=600,601    NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10       NLP=BR1
 BR2    J=2,14       NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401    NLP=TR
 TR2    J=702,402    NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000  I=162787,8558
  NAME=WG MAT=WG A=109  J=24000  I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720   I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6    I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=108,701   SEC=RG
 RT2  J=208,702
 RT3  J=109,703
 RT4  J=209,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-250
 ;AUX HOIST LOAD
    ADD=600  UZ=-0

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1          SF=1/5
  HIST=A2          SF=1/5
  HIST=A3          SF=1/5
  HIST=A4          SF=1/5
  HIST=A5          SF=1/5

 NAME=C09
  LOAD=DL          SF=1
  LOAD=LL            SF=1
  COMB=EQ          SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-10

```
CASE10 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT MID-SPAN
;MH HOOK UP WITH NO LOAD
;AH HOOK UP WITH LOAD
;FILE: Case10.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120     Z=0
102    X=146     Y=-120     Z=0
103    X=284     Y=-120     Z=0
104    X=458.5   Y=-120     Z=0
105    X=495     Y=-120     Z=0
106    X=604.5   Y=-120     Z=0
107    X=706     Y=-120     Z=0
108    X=844     Y=-120     Z=0
109    X=990     Y=-120     Z=0
;WEST IDLER GIRDER
201    X=0       Y=120      Z=0
202    X=146     Y=120      Z=0
203    X=284     Y=120      Z=0
204    X=458.5   Y=120      Z=0
205    X=495     Y=120      Z=0
206    X=604.5   Y=120      Z=0
207    X=706     Y=120      Z=0
208    X=844     Y=120      Z=0
209    X=990     Y=120      Z=0
;BRIDGE WHEELS
1      X=0       Y=-156     Z=-1.5
2      X=990     Y=-156     Z=-1.5
10     X=0       Y=-156     Z=-1.5
11     X=0       Y=-84      Z=-1.5
12     X=0       Y=84       Z=-1.5
13     X=0       Y=156      Z=-1.5
14     X=990     Y=-156     Z=-1.5
15     X=990     Y=-84      Z=-1.5
16     X=990     Y=84       Z=-1.5
17     X=990     Y=156      Z=-1.5
;TRUCKS
21     X=0       Y=-156     Z=15
100    X=0       Y=-120     Z=15
22     X=0       Y=-84      Z=15
23     X=0       Y=84       Z=15
200    X=0       Y=120      Z=15
24     X=0       Y=156      Z=15
25     X=990     Y=-156     Z=15
110    X=990     Y=-120     Z=15
26     X=990     Y=-84      Z=15
27     X=990     Y=84       Z=15
210    X=990     Y=120      Z=15
28     X=990     Y=156      Z=15
;END TIES
801   X=0        Y=-120    Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=458.5  Y=-120    Z=56.25
402    X=458.5  Y=120     Z=56.25
701    X=458.5  Y=-120    Z=56.25
702    X=458.5  Y=120     Z=56.25
703    X=604.5  Y=-120    Z=56.25
704    X=604.5  Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=458.5  Y=-120      Z=81
302   X=458.5  Y=120       Z=81
303   X=604.5  Y=-120      Z=81
304    X=604.5  Y=120      Z=81
;TROLLEY HOIST CENTERS
501   X=531.5  Y=0       Z=81 ;MAIN HOIST
601   X=477.5  Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=531.5  Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=477.5  Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=30+2/386.1         UY=30+2/386.1         UZ=30+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=30+2/72 ;(W/L)
  DOF=U3   KE=30+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01  J=301,601   SEC=RG
 R02  J=302,601
 R03  J=303,501
 R04  J=304,501
 R05  J=601,501
 ;TROLLEY WHEELS
 RT1  J=104,701   SEC=RG
 RT2  J=204,702
 RT3  J=106,703
 RT4  J=206,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-30

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C10
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-11

```
CASE11 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT QUARTER-SPAN
;MH HOOK UP NO LOAD
;AH HOOK UP WITH LOAD
;FILE: Case11.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=633     Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=852     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=633     Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=852     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=706     Y=-120    Z=56.25
402    X=706     Y=120     Z=56.25
701    X=706     Y=-120    Z=56.25
702    X=706     Y=120     Z=56.25
703    X=852     Y=-120    Z=56.25
704    X=852     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=706     Y=-120      Z=81
302   X=706     Y=120       Z=81
303   X=852     Y=-120      Z=81
304    X=852     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=779     Y=0       Z=81 ;MAIN HOIST
601   X=725     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=779     Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=725     Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=30+2/386.1         UY=30+2/386.1         UZ=30+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=30+2/72 ;(W/L)
  DOF=U3   KE=30+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0              M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=107,701   SEC=RG
 RT2  J=207,702
 RT3  J=108,703
 RT4  J=208,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-30

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C11
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-12

```
CASE12 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT END-SPAN
;MH HOOK UP NO LOAD
;AH HOOK UP WITH LOAD
;FILE: Case12.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120    Z=0
102    X=146     Y=-120    Z=0
103    X=284     Y=-120    Z=0
104    X=458.5   Y=-120    Z=0
105    X=495     Y=-120    Z=0
106    X=624.5   Y=-120    Z=0
107    X=706     Y=-120    Z=0
108    X=844     Y=-120    Z=0
109    X=990     Y=-120    Z=0
;WEST IDLER GIRDER
201    X=0       Y=120     Z=0
202    X=146     Y=120     Z=0
203    X=284     Y=120     Z=0
204    X=458.5   Y=120     Z=0
205    X=495     Y=120     Z=0
206    X=624.5   Y=120     Z=0
207    X=706     Y=120     Z=0
208    X=844     Y=120     Z=0
209    X=990     Y=120     Z=0
;BRIDGE WHEELS
1      X=0       Y=-156    Z=-1.5
2      X=990     Y=-156    Z=-1.5
10     X=0       Y=-156    Z=-1.5
11     X=0       Y=-84     Z=-1.5
12     X=0       Y=84      Z=-1.5
13     X=0       Y=156     Z=-1.5
14     X=990     Y=-156    Z=-1.5
15     X=990     Y=-84     Z=-1.5
16     X=990     Y=84      Z=-1.5
17     X=990     Y=156     Z=-1.5
;TRUCKS
21     X=0       Y=-156    Z=15
100    X=0       Y=-120    Z=15
22     X=0       Y=-84     Z=15
23     X=0       Y=84      Z=15
200    X=0       Y=120     Z=15
24     X=0       Y=156     Z=15
25     X=990     Y=-156    Z=15
110    X=990     Y=-120    Z=15
26     X=990     Y=-84     Z=15
27     X=990     Y=84      Z=15
210    X=990     Y=120     Z=15
28     X=990     Y=156     Z=15
;END TIES
801   X=0        Y=-120   Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=844     Y=-120    Z=56.25
402    X=844     Y=120     Z=56.25
701    X=844     Y=-120    Z=56.25
702    X=844     Y=120     Z=56.25
703    X=990     Y=-120    Z=56.25
704    X=990     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=844     Y=-120      Z=81
302   X=844     Y=120       Z=81
303   X=990     Y=-120      Z=81
304    X=990     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=917     Y=0       Z=81 ;MAIN HOIST
601   X=863     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=917     Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=863     Y=0       Z=81-72  ;HOOK UP L= 6 FT

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=30+2/386.1         UY=30+2/386.1         UZ=30+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=30+2/72 ;(W/L)
  DOF=U3   KE=30+2/72 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=108,701   SEC=RG
 RT2  J=208,702
 RT3  J=109,703
 RT4  J=209,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-30

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C12
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-13

```
CASE13 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT MID-SPAN
;MH HOOK UP WITH NO LOAD
;AH HOOK DOWN WITH LOAD
;FILE: Case13.s2k

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120     Z=0
102    X=146     Y=-120     Z=0
103    X=284     Y=-120     Z=0
104    X=458.5   Y=-120     Z=0
105    X=495     Y=-120     Z=0
106    X=604.5   Y=-120     Z=0
107    X=706     Y=-120     Z=0
108    X=844     Y=-120     Z=0
109    X=990     Y=-120     Z=0
;WEST IDLER GIRDER
201    X=0       Y=120      Z=0
202    X=146     Y=120      Z=0
203    X=284     Y=120      Z=0
204    X=458.5   Y=120      Z=0
205    X=495     Y=120      Z=0
206    X=604.5   Y=120      Z=0
207    X=706     Y=120      Z=0
208    X=844     Y=120      Z=0
209    X=990     Y=120      Z=0
;BRIDGE WHEELS
1      X=0       Y=-156     Z=-1.5
2      X=990     Y=-156     Z=-1.5
10     X=0       Y=-156     Z=-1.5
11     X=0       Y=-84      Z=-1.5
12     X=0       Y=84       Z=-1.5
13     X=0       Y=156      Z=-1.5
14     X=990     Y=-156     Z=-1.5
15     X=990     Y=-84      Z=-1.5
16     X=990     Y=84       Z=-1.5
17     X=990     Y=156      Z=-1.5
;TRUCKS
21     X=0       Y=-156     Z=15
100    X=0       Y=-120     Z=15
22     X=0       Y=-84      Z=15
23     X=0       Y=84       Z=15
200    X=0       Y=120      Z=15
24     X=0       Y=156      Z=15
25     X=990     Y=-156     Z=15
110    X=990     Y=-120     Z=15
26     X=990     Y=-84      Z=15
27     X=990     Y=84       Z=15
210    X=990     Y=120      Z=15
28     X=990     Y=156      Z=15
;END TIES
801   X=0       Y=-120   Z=47
802   X=0       Y=0      Z=47
```

```
803   X=0        Y=120    Z=47
804   X=990      Y=-120   Z=47
805   X=990    Y=0      Z=47
806   X=990      Y=120    Z=47
;TROLLEY WHEELS
401    X=458.5  Y=-120   Z=56.25
402    X=458.5  Y=120    Z=56.25
701    X=458.5  Y=-120   Z=56.25
702    X=458.5  Y=120    Z=56.25
703    X=604.5  Y=-120   Z=56.25
704    X=604.5  Y=120    Z=56.25
;TROLLEY PLATFORM
301    X=458.5  Y=-120     Z=81
302   X=458.5  Y=120       Z=81
303   X=604.5  Y=-120      Z=81
304    X=604.5  Y=120      Z=81
;TROLLEY HOIST CENTERS
501   X=531.5  Y=0      Z=81 ;MAIN HOIST
601   X=477.5  Y=0      Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=531.5  Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=477.5  Y=0      Z=81-844 ;HOOK DOWN L= 70 FT 4 IN

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=30+2/386.1         UY=30+2/386.1         UZ=30+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/844 ;(EA/L)
  DOF=U2   KE=30+2/844 ;(W/L)
  DOF=U3   KE=30+2/844 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
  DOF=U3   KE=1E6
```

```
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
 TK8  J=210,28
```

```
 ;TROLLEY HOIST PLATFORM
 R01  J=301,601   SEC=RG
 R02  J=302,601
 R03  J=303,501
 R04  J=304,501
 R05  J=601,501
 ;TROLLEY WHEELS
 RT1  J=104,701   SEC=RG
 RT2  J=204,702
 RT3  J=106,703
 RT4  J=206,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-30

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a3xNS  SF=386.1
```

```
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C13
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-14

```
CASE14 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT QUARTER-SPAN
;MH HOOK UP NO LOAD
;AH HOOK DOWN WITH LOAD
;FILE: Case14.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120     Z=0
102    X=146     Y=-120     Z=0
103    X=284     Y=-120     Z=0
104    X=458.5   Y=-120     Z=0
105    X=495     Y=-120     Z=0
106    X=633     Y=-120     Z=0
107    X=706     Y=-120     Z=0
108    X=852     Y=-120     Z=0
109    X=990     Y=-120     Z=0
;WEST IDLER GIRDER
201    X=0       Y=120      Z=0
202    X=146     Y=120      Z=0
203    X=284     Y=120      Z=0
204    X=458.5   Y=120      Z=0
205    X=495     Y=120      Z=0
206    X=633     Y=120      Z=0
207    X=706     Y=120      Z=0
208    X=852     Y=120      Z=0
209    X=990     Y=120      Z=0
;BRIDGE WHEELS
1      X=0       Y=-156     Z=-1.5
2      X=990     Y=-156     Z=-1.5
10     X=0       Y=-156     Z=-1.5
11     X=0       Y=-84      Z=-1.5
12     X=0       Y=84       Z=-1.5
13     X=0       Y=156      Z=-1.5
14     X=990     Y=-156     Z=-1.5
15     X=990     Y=-84      Z=-1.5
16     X=990     Y=84       Z=-1.5
17     X=990     Y=156      Z=-1.5
;TRUCKS
21     X=0       Y=-156     Z=15
100    X=0       Y=-120     Z=15
22     X=0       Y=-84      Z=15
23     X=0       Y=84       Z=15
200    X=0       Y=120      Z=15
24     X=0       Y=156      Z=15
25     X=990     Y=-156     Z=15
110    X=990     Y=-120     Z=15
26     X=990     Y=-84      Z=15
27     X=990     Y=84       Z=15
210    X=990     Y=120      Z=15
28     X=990     Y=156      Z=15
;END TIES
801   X=0        Y=-120    Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=706     Y=-120    Z=56.25
402    X=706     Y=120     Z=56.25
701    X=706     Y=-120    Z=56.25
702    X=706     Y=120     Z=56.25
703    X=852     Y=-120    Z=56.25
704    X=852     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=706     Y=-120      Z=81
302   X=706     Y=120       Z=81
303   X=852     Y=-120      Z=81
304    X=852     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=779     Y=0       Z=81 ;MAIN HOIST
601   X=725     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=779     Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=725  Y=0       Z=81-844 ;HOOK DOWN L= 70 FT 4 IN

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=30+2/386.1         UY=30+2/386.1         UZ=30+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/844 ;(EA/L)
  DOF=U2   KE=30+2/844 ;(W/L)
  DOF=U3   KE=30+2/844 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01   J=301,601   SEC=RG
 R02   J=302,601
 R03   J=303,501
 R04   J=304,501
 R05   J=601,501
 ;TROLLEY WHEELS
 RT1  J=107,701   SEC=RG
 RT2  J=207,702
 RT3  J=108,703
 RT4  J=208,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-30

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C14
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## Case-15

```
CASE15 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES
;TROLLEY AT END-SPAN
;MH HOOK UP NO LOAD
;AH HOOK DOWN WITH LOAD
;FILE: Case15.s2k
;TWO JOINT DRIVE WHEEL SUPPORT

SYSTEM
  FORCE=KIP  LENGTH=IN

MODES
 TYPE=RITZ N=20
   ACC=UX
   ACC=UY
   ACC=UZ
   NLLINK=*

JOINT
;EAST DRIVE GIRDER
101    X=0       Y=-120     Z=0
102    X=146     Y=-120     Z=0
103    X=284     Y=-120     Z=0
104    X=458.5   Y=-120     Z=0
105    X=495     Y=-120     Z=0
106    X=624.5   Y=-120     Z=0
107    X=706     Y=-120     Z=0
108    X=844     Y=-120     Z=0
109    X=990     Y=-120     Z=0
;WEST IDLER GIRDER
201    X=0       Y=120      Z=0
202    X=146     Y=120      Z=0
203    X=284     Y=120      Z=0
204    X=458.5   Y=120      Z=0
205    X=495     Y=120      Z=0
206    X=624.5   Y=120      Z=0
207    X=706     Y=120      Z=0
208    X=844     Y=120      Z=0
209    X=990     Y=120      Z=0
;BRIDGE WHEELS
1      X=0       Y=-156     Z=-1.5
2      X=990     Y=-156     Z=-1.5
10     X=0       Y=-156     Z=-1.5
11     X=0       Y=-84      Z=-1.5
12     X=0       Y=84       Z=-1.5
13     X=0       Y=156      Z=-1.5
14     X=990     Y=-156     Z=-1.5
15     X=990     Y=-84      Z=-1.5
16     X=990     Y=84       Z=-1.5
17     X=990     Y=156      Z=-1.5
;TRUCKS
21     X=0       Y=-156     Z=15
100    X=0       Y=-120     Z=15
22     X=0       Y=-84      Z=15
23     X=0       Y=84       Z=15
200    X=0       Y=120      Z=15
24     X=0       Y=156      Z=15
25     X=990     Y=-156     Z=15
110    X=990     Y=-120     Z=15
26     X=990     Y=-84      Z=15
27     X=990     Y=84       Z=15
210    X=990     Y=120      Z=15
28     X=990     Y=156      Z=15
;END TIES
801   X=0        Y=-120    Z=47
```

```
802   X=0       Y=0       Z=47
803   X=0        Y=120     Z=47
804   X=990      Y=-120    Z=47
805   X=990     Y=0       Z=47
806   X=990      Y=120     Z=47
;TROLLEY WHEELS
401    X=844     Y=-120    Z=56.25
402    X=844     Y=120     Z=56.25
701    X=844     Y=-120    Z=56.25
702    X=844     Y=120     Z=56.25
703    X=990     Y=-120    Z=56.25
704    X=990     Y=120     Z=56.25
;TROLLEY PLATFORM
301    X=844     Y=-120      Z=81
302   X=844     Y=120       Z=81
303   X=990     Y=-120      Z=81
304    X=990     Y=120       Z=81
;TROLLEY HOIST CENTERS
501   X=917     Y=0       Z=81 ;MAIN HOIST
601   X=863     Y=0       Z=81 ;AUX HOIST
;MAIN HOIST HOOK
500    X=917     Y=0  Z=81-84 ;HOOK UP L= 7 FT
;AUX HOIST HOOK
600   X=863     Y=0       Z=81-844  ;HOOK DOWN L=70'-4"

RESTRAINTS
  ADD=1  DOF=ALL
  ADD=2  DOF=ALL
  ADD=11 DOF=UX,UZ
  ADD=12 DOF=UX,UZ
  ADD=13 DOF=UX,UZ
  ADD=15 DOF=UZ
  ADD=16 DOF=UZ
  ADD=17 DOF=UZ
;HOOK ROTATION
  ADD=500 DOF=RX,RY,RZ
  ADD=600 DOF=RX,RY,RZ

MASS
;TROLLEY MAIN HOIST 80% OF TOTAL LESS HOOKS
  ADD=501  UX=112-8-2*.80/386.1  UY=112-8-2*.80/386.1  UZ=112-8-2*.80/386.1
;TROLLEY AUXILIARY HOIST 20% OF TOTAL LESS HOOKS
  ADD=601  UX=112-8-2*.20/386.1  UY=112-8-2*.20/386.1  UZ=112-8-2*.20/386.1
;MH LIFTED LOAD AND HOOK
  ADD=500  UX=0+8/386.1          UY=0+8/386.1          UZ=0+8/386.1
;AH LIFTED LOAD AND HOOK
  ADD=600  UX=30+2/386.1         UY=30+2/386.1         UZ=30+2/386.1

NLPROP
 NAME=PENDMH  TYPE=PLASTIC1
  DOF=U1   KE=13360*16*0.9572/84 ;(EA/L)
  DOF=U2   KE=0+8/84 ;(W/L)
  DOF=U3   KE=0+8/84 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=PENDAH  TYPE=PLASTIC1
  DOF=U1   KE=13360*8*0.4690/72 ;(EA/L)
  DOF=U2   KE=30+2/844 ;(W/L)
  DOF=U3   KE=30+2/844 ;(W/L)
  DOF=R1   KE=0.001
  DOF=R2   KE=0.001
  DOF=R3   KE=0.001
 NAME=TR   TYPE=PLASTIC1 M=1E-4 ;TROLLEY NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1  K=0.5E3  YIELD=4.0  RATIO=0.0  EXP=20
```

```
  DOF=U3   KE=1E6
 NAME=BR1  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U2   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20
 NAME=BR2  TYPE=PLASTIC1 M=1E-4 ;BRIDGE NON-LINEAR RESPONSE
  DOF=U1   KE=1E6
  DOF=U3   KE=3  K=1.5E3  YIELD=8.0  RATIO=0.0  EXP=20

NLLINK
 MHOOK  J=500,501   NLP=PENDMH
 AHOOK  J=600,601   NLP=PENDAH
;BRIDGE DRIVE WHEELS
 BR1    J=1,10      NLP=BR1
 BR2    J=2,14      NLP=BR2
;TROLLEY DRIVE WHEELS
 TR1    J=701,401   NLP=TR
 TR2    J=702,402   NLP=TR

MATERIAL
 NAME=EG     W=45/109/990     M=45/109/990/386.1      ;E GIRDER
  E=29000    U=0.3
 NAME=WG     W=40/109/990     M=40/109/990/386.1      ;W GIRDER
  E=29000    U=0.3
;DISTRIBUTE 1/4  OF 21K WEIGHT TO TIES AND 3/4 WEIGHT TO TRUCKS
 NAME=ET     W=21/4/2/33/240  M=21/4/2/33/240/386.1   ;2 END TIES
  E=29000    U=0.3
 NAME=TK     W=21*3/4/4/54/72 M=21*3/4/4/54/72/386.1  ;4 BRIDGE TRUCKS
  E=29000    U=0.3
 NAME=RG     W=0                M=0 ;RIGID ELEMENTS
  E=1E4      U=0.3

FRAME SECTION
  NAME=EG MAT=EG A=109  J=24000 I=162787,8558
  NAME=WG MAT=WG A=109  J=24000 I=162787,8558
  NAME=ET MAT=ET A=33   J=4.68   I=376,2894
  NAME=TK MAT=TK A=54   J=1720  I=6225,1372
  NAME=RG MAT=RG A=1E4  J=1E6   I=1E6,1E6

FRAME
 ;EAST GIRDER
 G01   J=101,102    SEC=EG
 G02   J=102,103
 G03   J=103,104
 G04   J=104,105
 G05   J=105,106
 G06   J=106,107
 G07   J=107,108
 G08   J=108,109
 ;WEST GIRDER
 G09   J=201,202    SEC=WG
 G10   J=202,203
 G11   J=203,204
 G12   J=204,205
 G13   J=205,206
 G14   J=206,207
 G15   J=207,208
 G16   J=208,209
 ;END TRUCKS
 TK1  J=21,100    SEC=TK
 TK2  J=100,22
 TK3  J=23,200
 TK4  J=200,24
 TK5  J=25,110
 TK6  J=110,26
 TK7  J=27,210
```

```
 TK8  J=210,28
 ;TROLLEY HOIST PLATFORM
 R01  J=301,601   SEC=RG
 R02  J=302,601
 R03  J=303,501
 R04  J=304,501
 R05  J=601,501
 ;TROLLEY WHEELS
 RT1  J=108,701   SEC=RG
 RT2  J=208,702
 RT3  J=109,703
 RT4  J=209,704
 RT5  J=401,301
 RT6  J=402,302
 RT7  J=703,303   IREL=U2,R1,R2,R3
 RT8  J=704,304   IREL=U2,R1,R2,R3
 ;BRIDGE END TIES
 ET1  J=801,802   SEC=ET
 ET2  J=802,803
 ET3  J=804,805
 ET4  J=805,806
 ;BRIDGE TRUCK WHEELS
 RB1  J=10,21     SEC=RG
 RB2  J=11,22
 RB3  J=12,23
 RB4  J=13,24
 RB5  J=14,25
 RB6  J=15,26
 RB7  J=16,27
 RB8  J=17,28
 R06  J=100,101
 R07  J=110,109
 R08  J=200,201
 R09  J=210,209
 R10  J=100,801
 R11  J=110,804
 R12  J=200,803
 R13  J=210,806

LOAD
 NAME=DL SW=1
   TYPE=FORCE
    ADD=501  UZ=-112+8+2*.80 ;80% OF TOTAL LESS HOOKS
    ADD=601  UZ=-112+8+2*.20 ;20% OF TOTAL LESS HOOKS
 ;MAIN HOIST HOOK
    ADD=500  UZ=-8
 ;AUX HOIST HOOK
    ADD=600  UZ=-2

 NAME=LL
   TYPE=FORCE
 ;MAIN HOIST LOAD
    ADD=500  UZ=-0
 ;AUX HOIST LOAD
    ADD=600  UZ=-30

HISTORY
 NAME=A1 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a1xNS  SF=386.1
  ACC=U2  FUNC=a1yEW  SF=386.1
  ACC=U3  FUNC=a1zVT  SF=386.1
 NAME=A2 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a2xNS  SF=386.1
  ACC=U2  FUNC=a2yEW  SF=386.1
  ACC=U3  FUNC=a2zVT  SF=386.1
 NAME=A3 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
```

```
  ACC=U1  FUNC=a3xNS  SF=386.1
  ACC=U2  FUNC=a3yEW  SF=386.1
  ACC=U3  FUNC=a3zVT  SF=386.1
 NAME=A4 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a4xNS  SF=386.1
  ACC=U2  FUNC=a4yEW  SF=386.1
  ACC=U3  FUNC=a4zVT  SF=386.1
 NAME=A5 TYPE=NON NSTEP=2500 DT=0.01 DAMP=0.02
  ACC=U1  FUNC=a5xNS  SF=386.1
  ACC=U2  FUNC=a5yEW  SF=386.1
  ACC=U3  FUNC=a5zVT  SF=386.1

COMBO
 NAME=EQ   TYPE=ABS  ;COMBINED AVERAGE
  HIST=A1         SF=1/5
  HIST=A2         SF=1/5
  HIST=A3         SF=1/5
  HIST=A4         SF=1/5
  HIST=A5         SF=1/5

 NAME=C15
  LOAD=DL         SF=1
  LOAD=LL         SF=1
  COMB=EQ         SF=1

FUNCTION
 NAME=a1xNS DT=0.01 NPL=1 FILE=a1xNS
 NAME=a1yEW DT=0.01 NPL=1 FILE=a1yEW
 NAME=a1zVT DT=0.01 NPL=1 FILE=a1zVT
 NAME=a2xNS DT=0.01 NPL=1 FILE=a2xNS
 NAME=a2yEW DT=0.01 NPL=1 FILE=a2yEW
 NAME=a2zVT DT=0.01 NPL=1 FILE=a2zVT
 NAME=a3xNS DT=0.01 NPL=1 FILE=a3xNS
 NAME=a3yEW DT=0.01 NPL=1 FILE=a3yEW
 NAME=a3zVT DT=0.01 NPL=1 FILE=a3zVT
 NAME=a4xNS DT=0.01 NPL=1 FILE=a4xNS
 NAME=a4yEW DT=0.01 NPL=1 FILE=a4yEW
 NAME=a4zVT DT=0.01 NPL=1 FILE=a4zVT
 NAME=a5xNS DT=0.01 NPL=1 FILE=a5xNS
 NAME=a5yEW DT=0.01 NPL=1 FILE=a5yEW
 NAME=a5zVT DT=0.01 NPL=1 FILE=a5zVT

END
```

## CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT J
## BRIDGE DRIVE GIRDER MOMENT AND SHEAR DIAGRAMS

### Tabularized Selected Output – FOR INFORMATION ONLY (3)
### For
### Load Cases 7, 8, and 9

**CONTENTS** **PAGE**


J.1 Strong Axis Bending for DL, LL, EQ, DL+LL+EQ, DL+LL-EQ
- J.1a Trolley at Mid-Span ..... J.2
- J.1b Trolley at Quarter-Span ..... J.2
- J.1c Trolley at End-Span ..... J.3

J.2 Strong Axis (Vertical) Shear for DL, LL, EQ, DL+LL+EQ, DL+LL-EQ
- J.2a Trolley at Mid-Span ..... J.3
- J.2b Trolley at Quarter-Span ..... J.4
- J.2c Trolley at End-Span ..... J.4

J.3 Weak Axis Bending (Seismic (2)) ..... J.5

J.4 Weak Axis Shear (Seismic (2)) ..... J.5

J.5 Torsion (Seismic (2)) ..... J.6

J.6 Axial (Seismic (2)) ..... J.6


**Total Pages = 6**

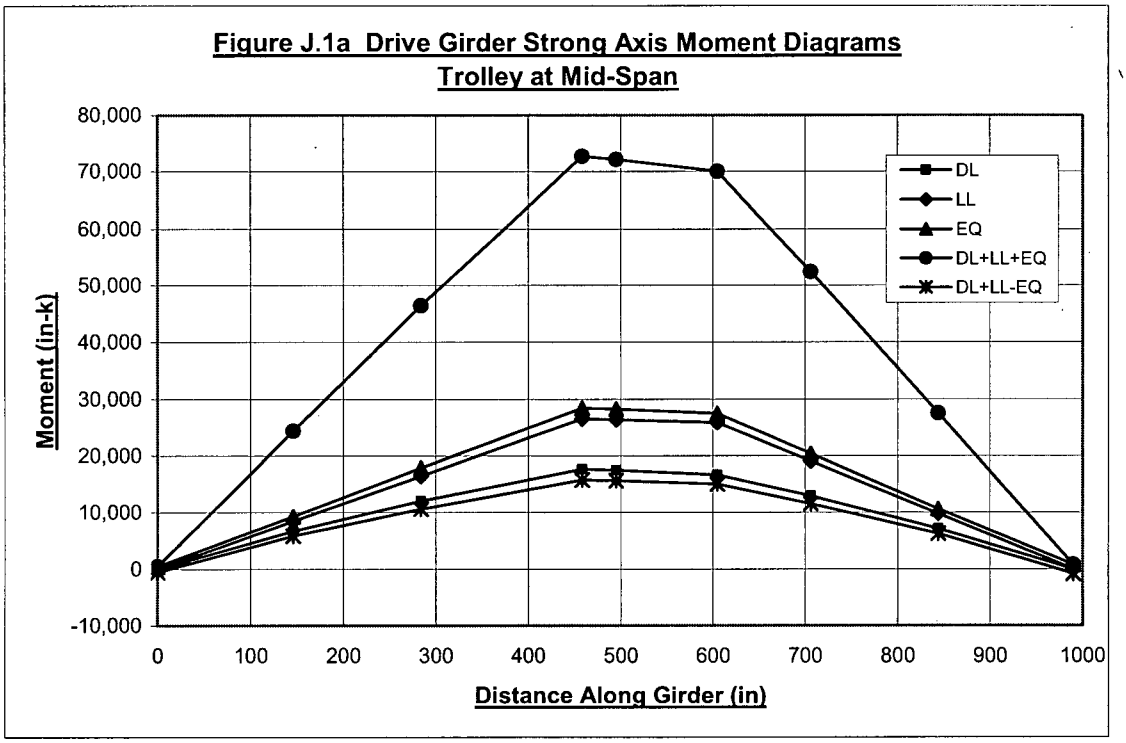
(1) Positive moment indicates downward girder loading for DL and LL conditions.

(2) DL and LL are not significant for lateral responses. Seismic loading is symmetric and only one direction is presented for clarity. Maximum absolute values plotted.

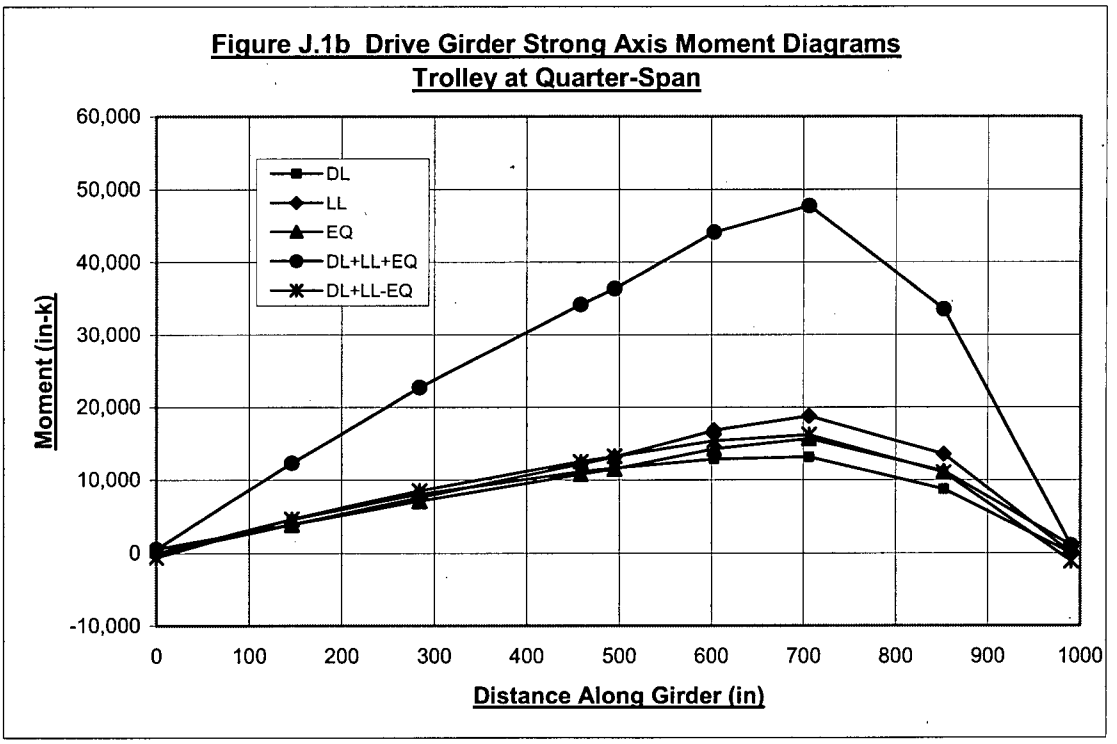
(3) Design is based on consideration of all Load Cases and not just the three cases presented in this attachment.

## J.1 Strong Axis Bending for DL, LL, EQ, DL+LL+EQ, DL+LL-EQ

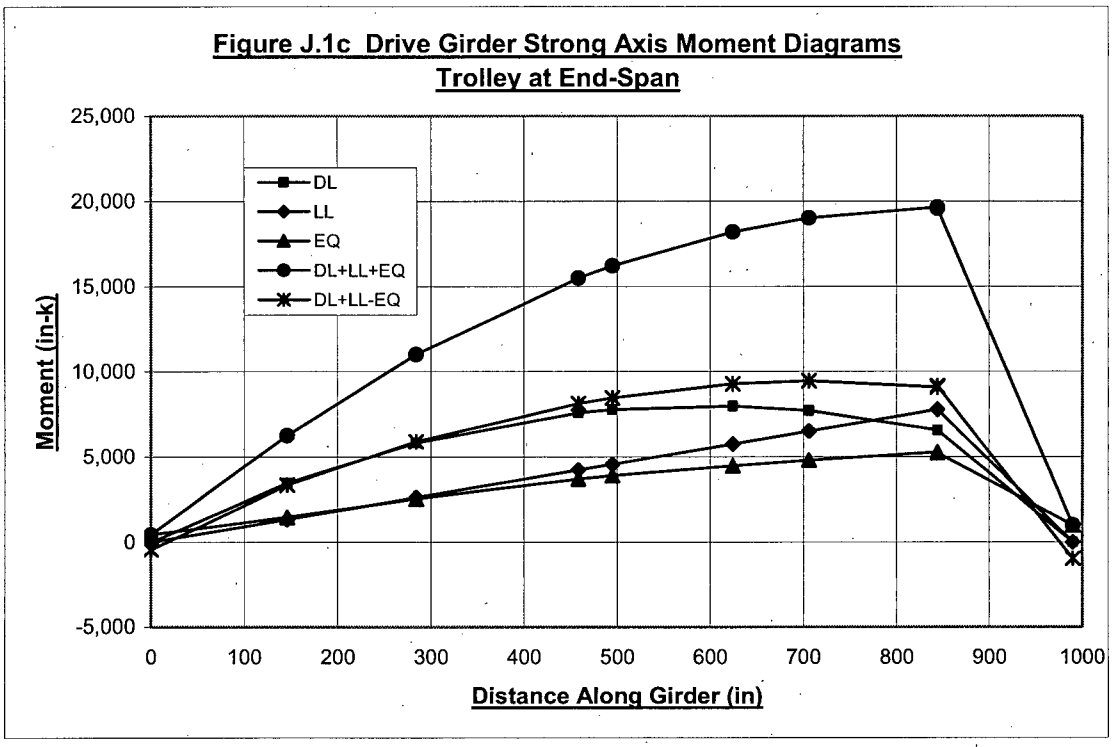
### J.1a Trolley at Mid-Span




### J.1b Trolley at Quarter-Span

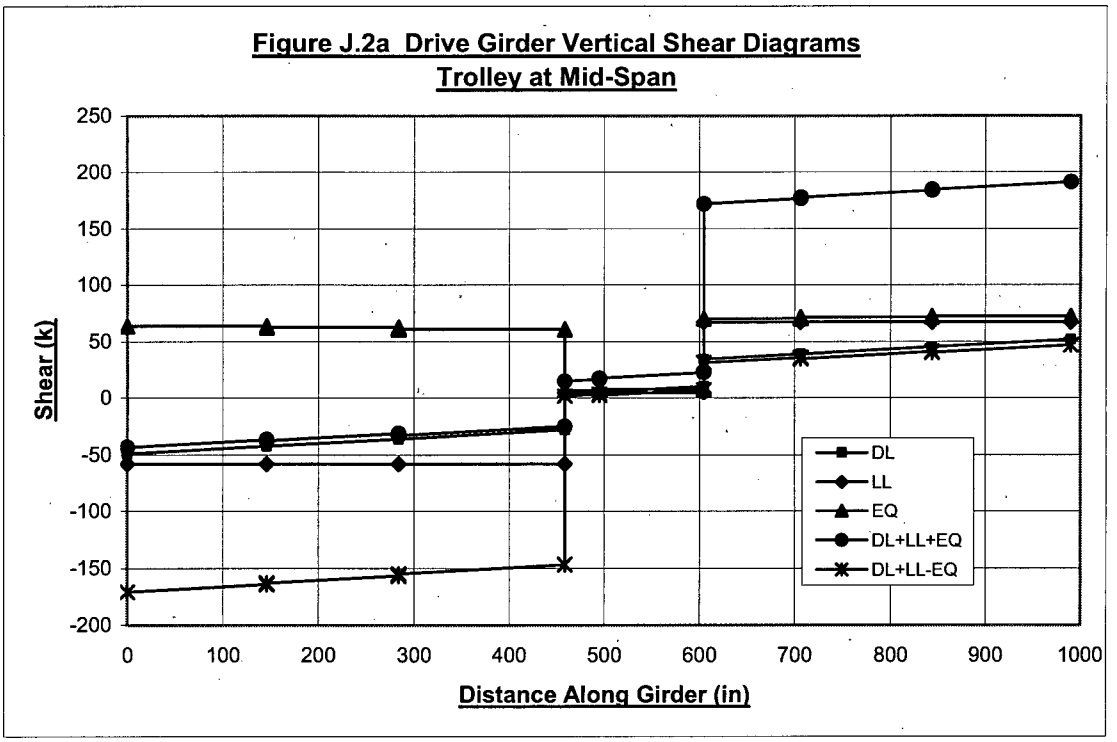


## J.1c Trolley at End-Span

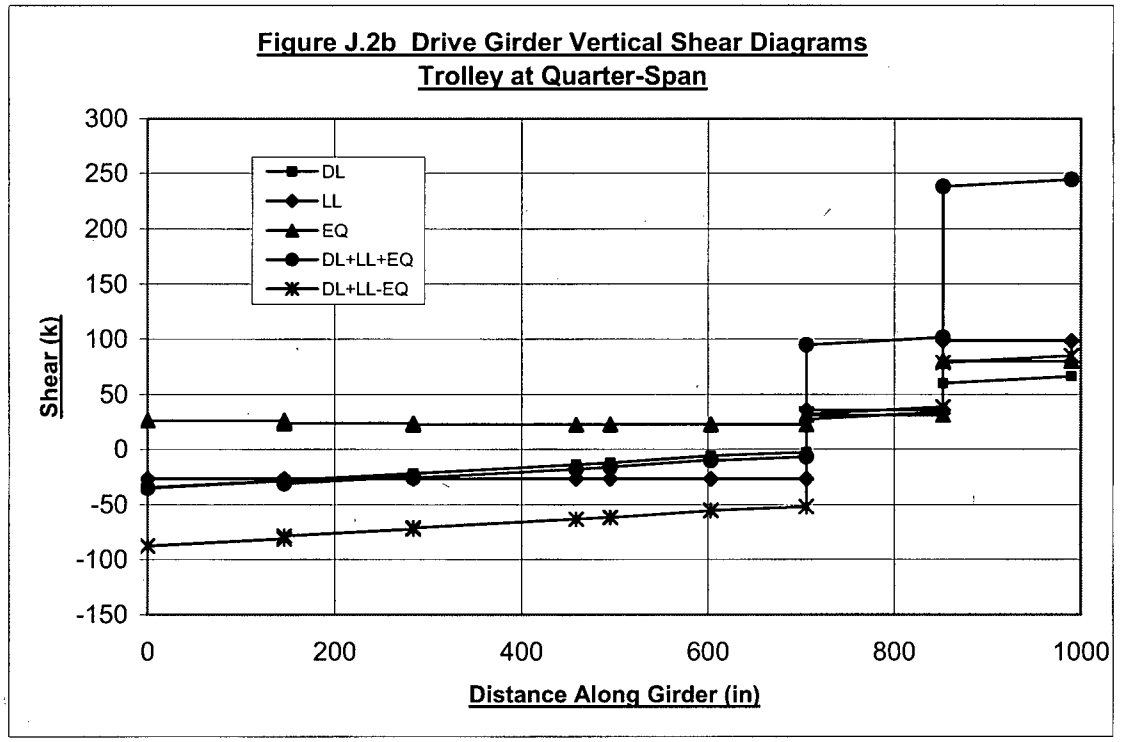



## J.2 Strong Axis (Vertical) Shear for DL, LL, EQ, DL+LL+EQ, DL+LL-EQ

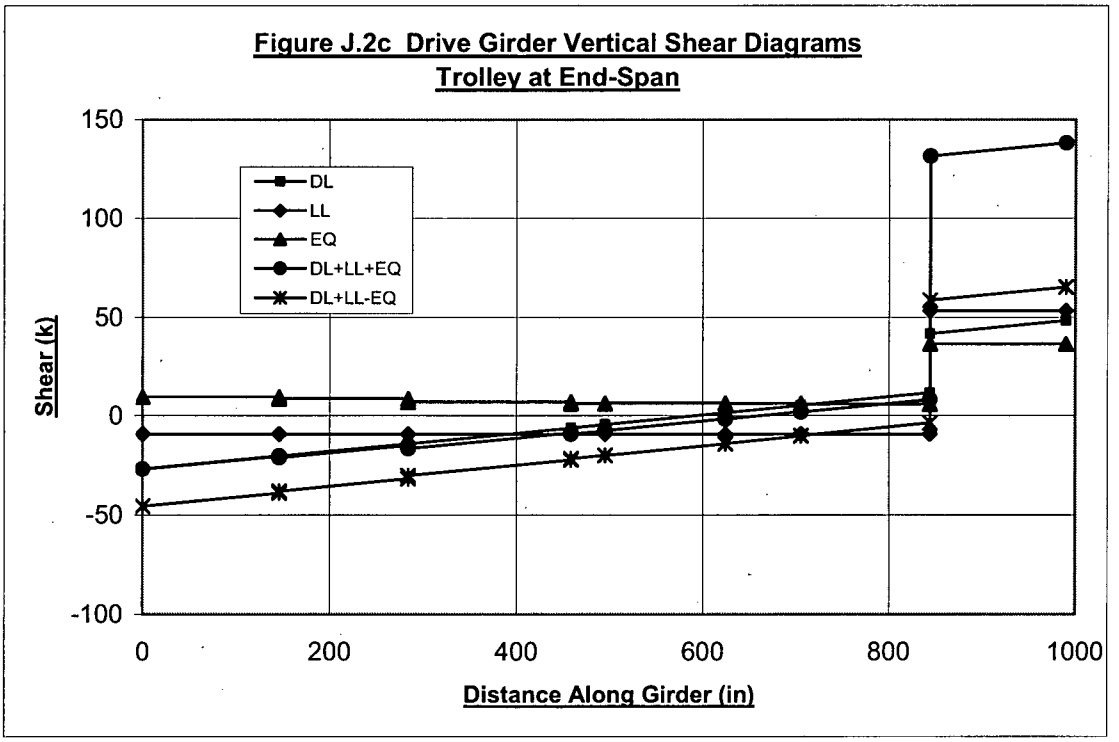
### J.2a Trolley at Mid-Span



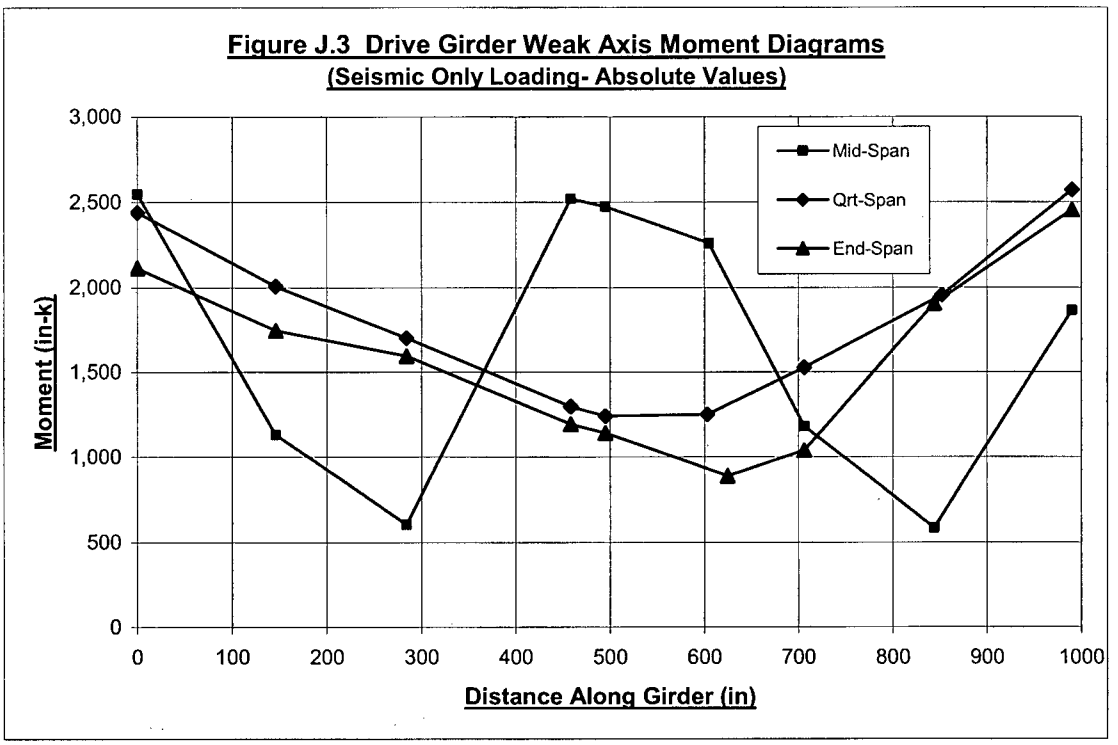
## J.2b Trolley at Quarter-Span



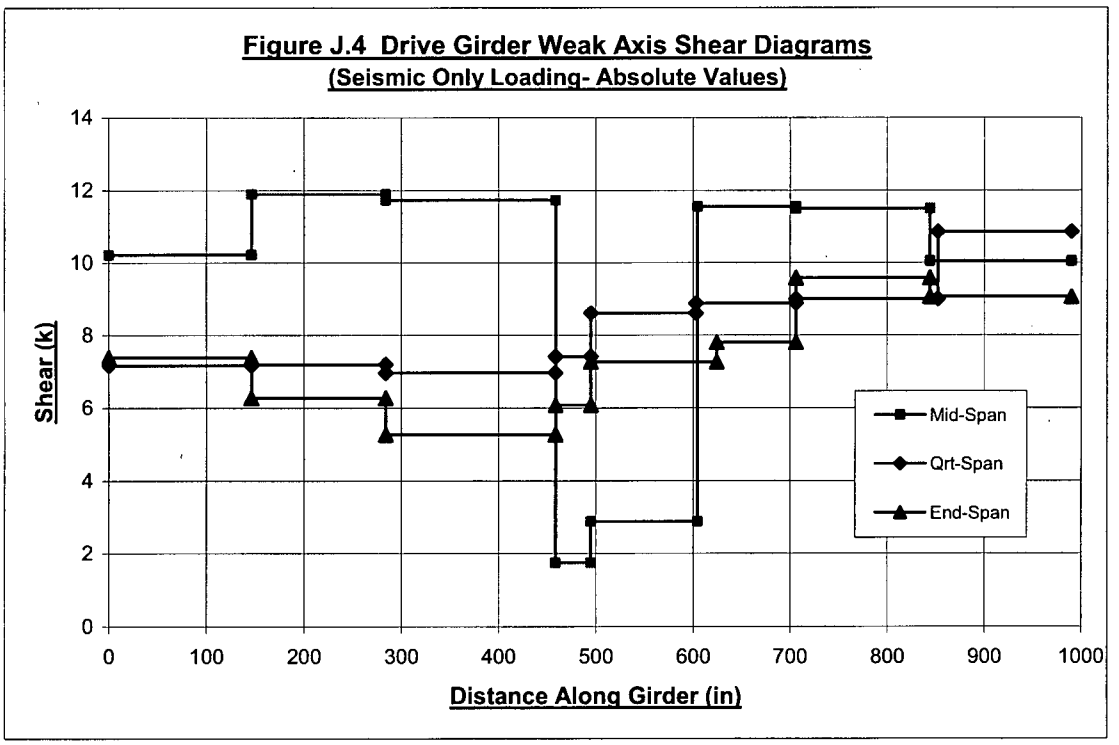

## J.2c Trolley at End-Span



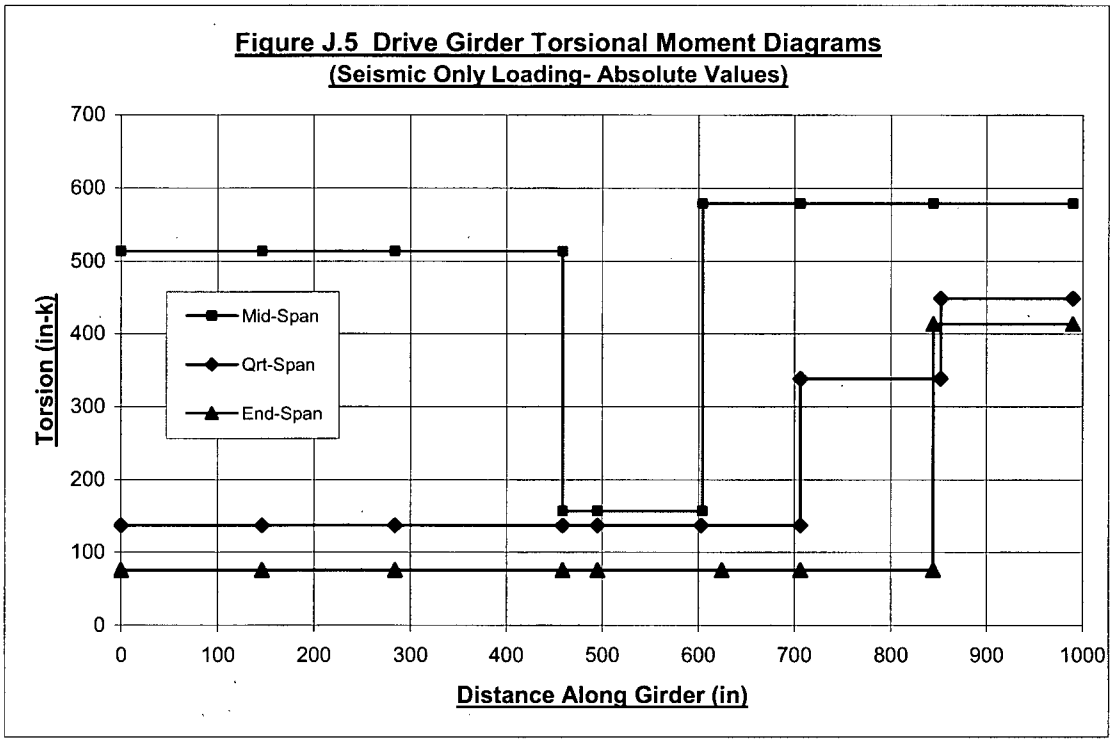
## J.3 Weak Axis Bending (Seismic [2])



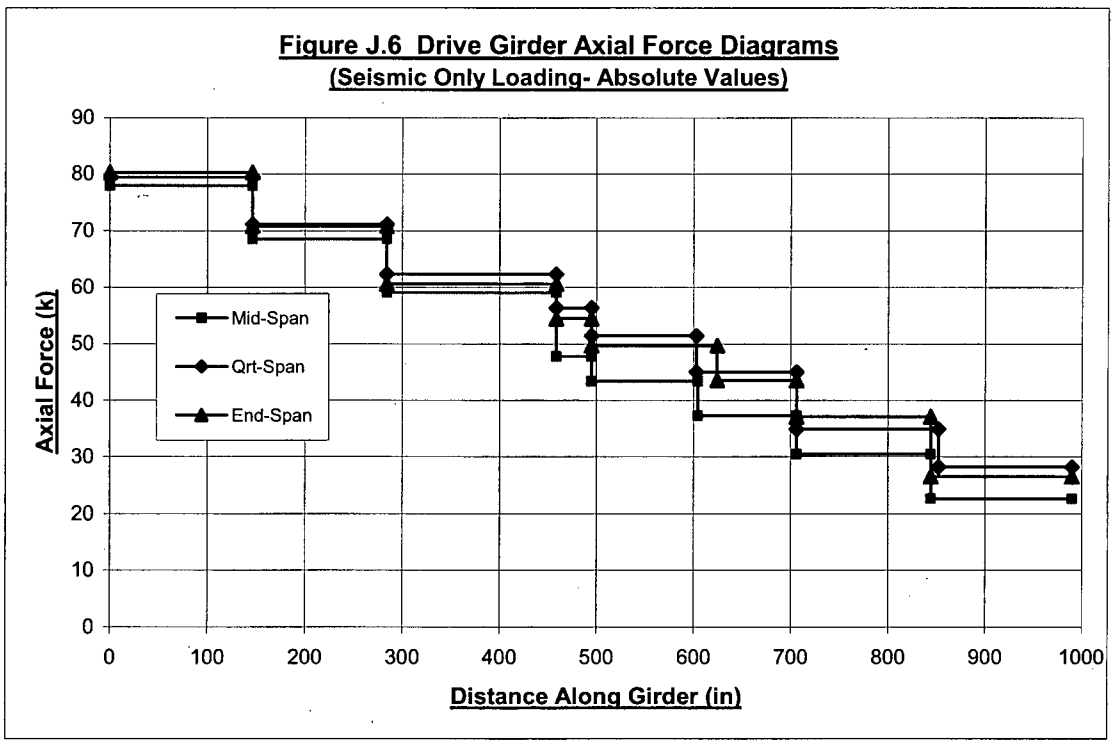

## J.4 Weak Axis Shear (Seismic [2])



## J.5 Torsion (Seismic [2])




## J.6 Axial (Seismic [2])



## CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT K

## BRIDGE (1) AND TROLLEY RELATIVE DISPLACEMENT TIME HISTORY RESPONSES

**Tabularized Selected Output – FOR INFORMATION ONLY (2)**

**For**

**Load Case-07 – Trolley at Mid-Span**

**Time Histories A1, A2, A3, A4, and A5**

**CONTENTS** **PAGE**


K.1 A1 Earthquake, X, NS Direction ..... K.2
K.2 A1 Earthquake, Y, EW Direction ..... K.2
K.3 A2 Earthquake, X, NS Direction ..... K.3
K.4 A2 Earthquake, Y, EW Direction ..... K.3
K.5 A3 Earthquake, X, NS Direction ..... K.4
K.6 A3 Earthquake, Y, EW Direction ..... K.4
K.7 A4 Earthquake, X, NS Direction ..... K.5
K.8 A4 Earthquake, Y, EW Direction ..... K.5
K.9 A5 Earthquake, X, NS Direction ..... K.6
K.10 A5 Earthquake, Y, EW Direction ..... K.6

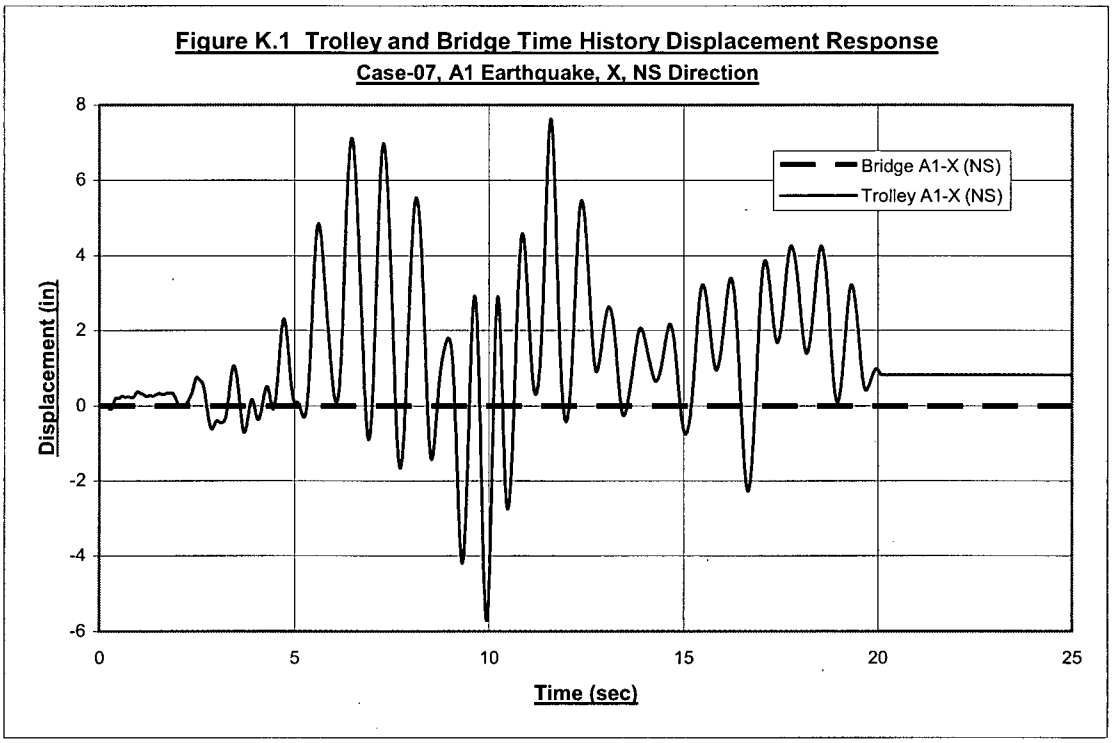

**Total Pages = 6**

**NOTES:**

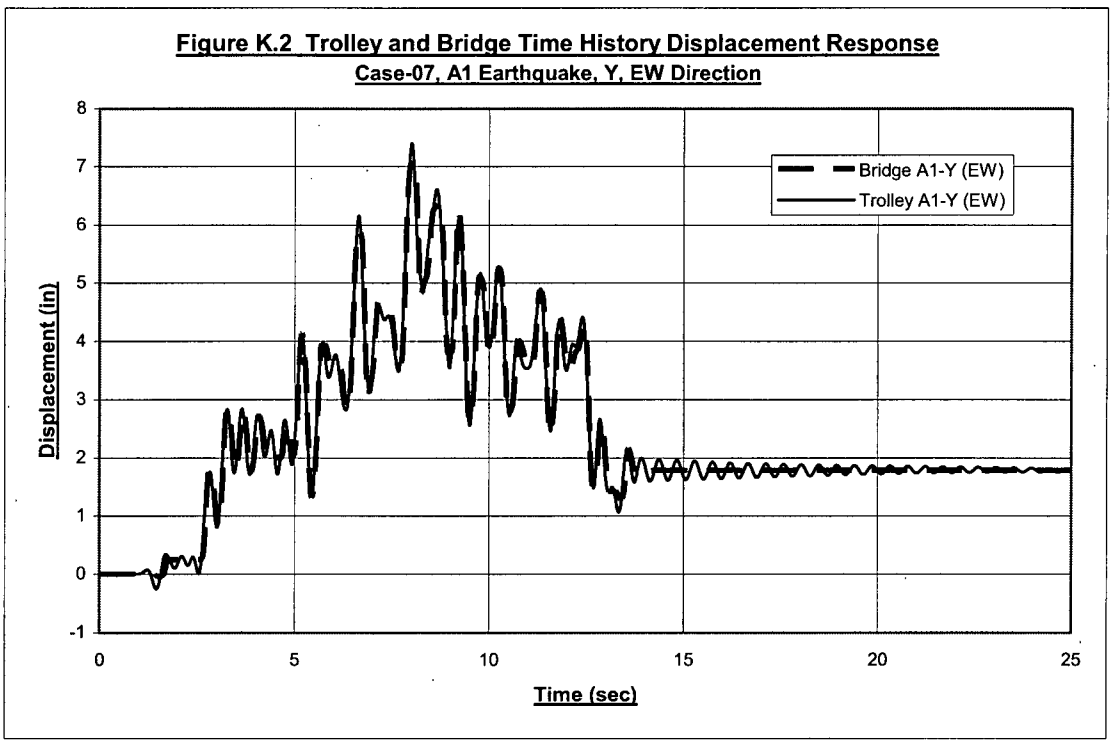
(1) Bridge displacement is presented for the South bridge drive wheel. North drive wheel displacements is different from the South drive wheel due to bridge skewing during the dynamic analyses.

(2) Design information is based on averaged maximum responses from all five time history sets and not on any single time history response as presented herein.

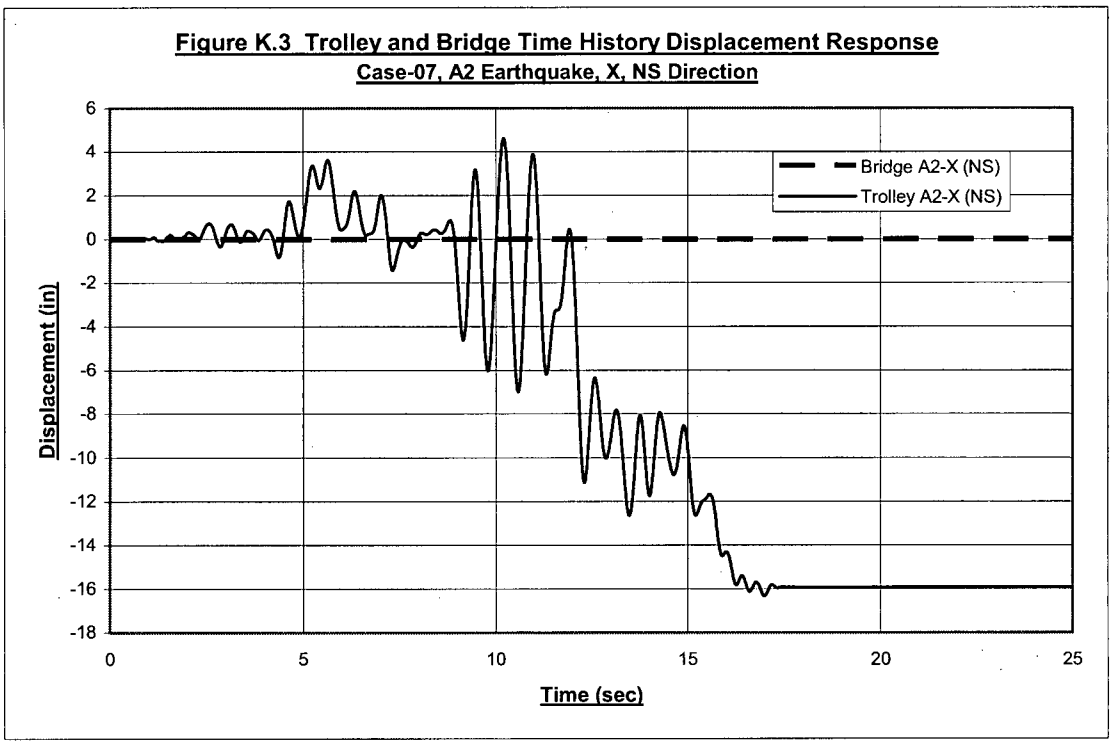
## K.1 A1 Earthquake, X, NS Direction



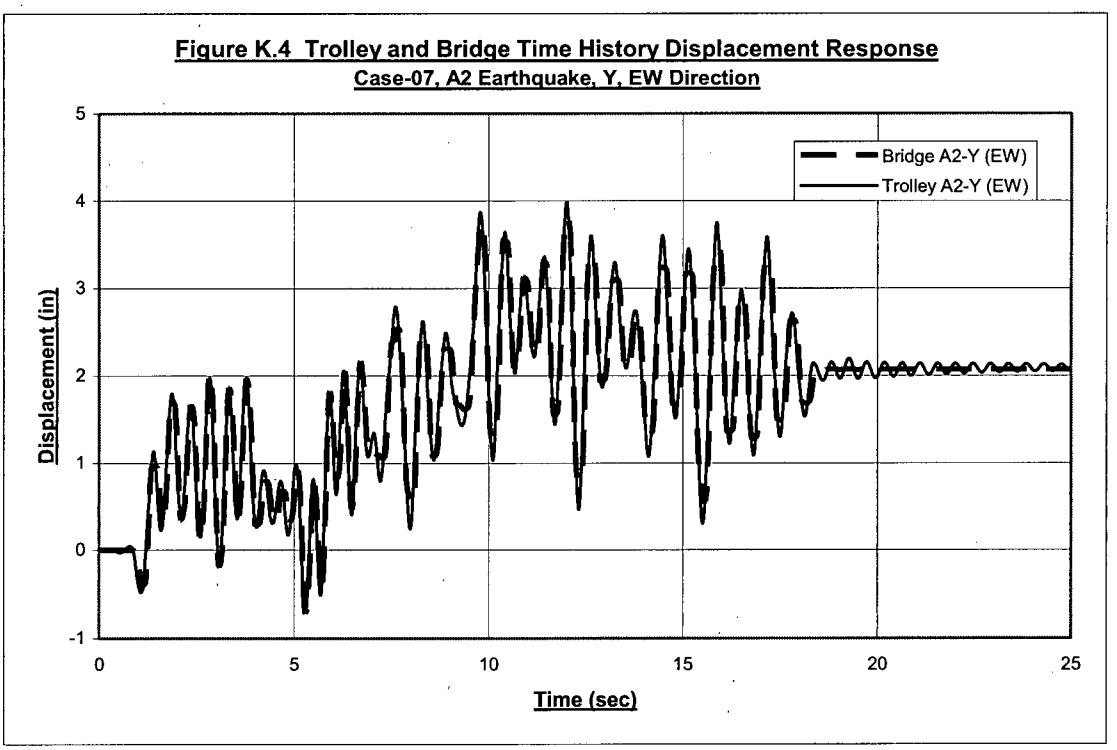

## K.2 A1 Earthquake, Y, EW Direction



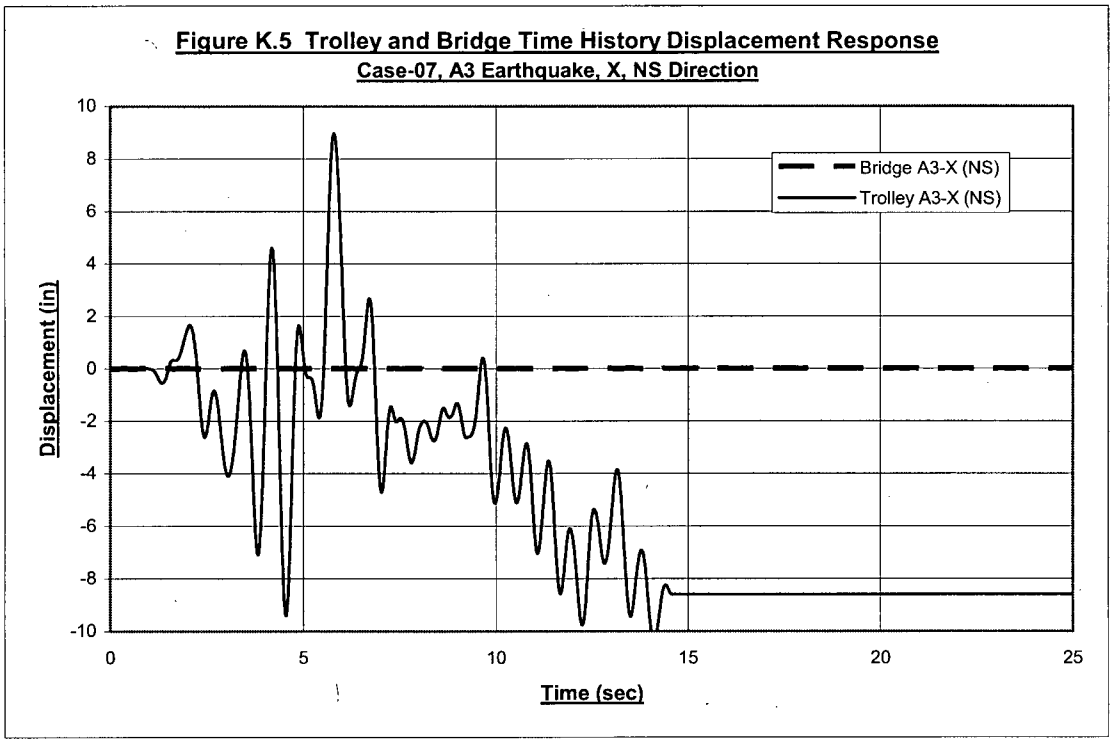
## K.3 A2 Earthquake, X, NS Direction



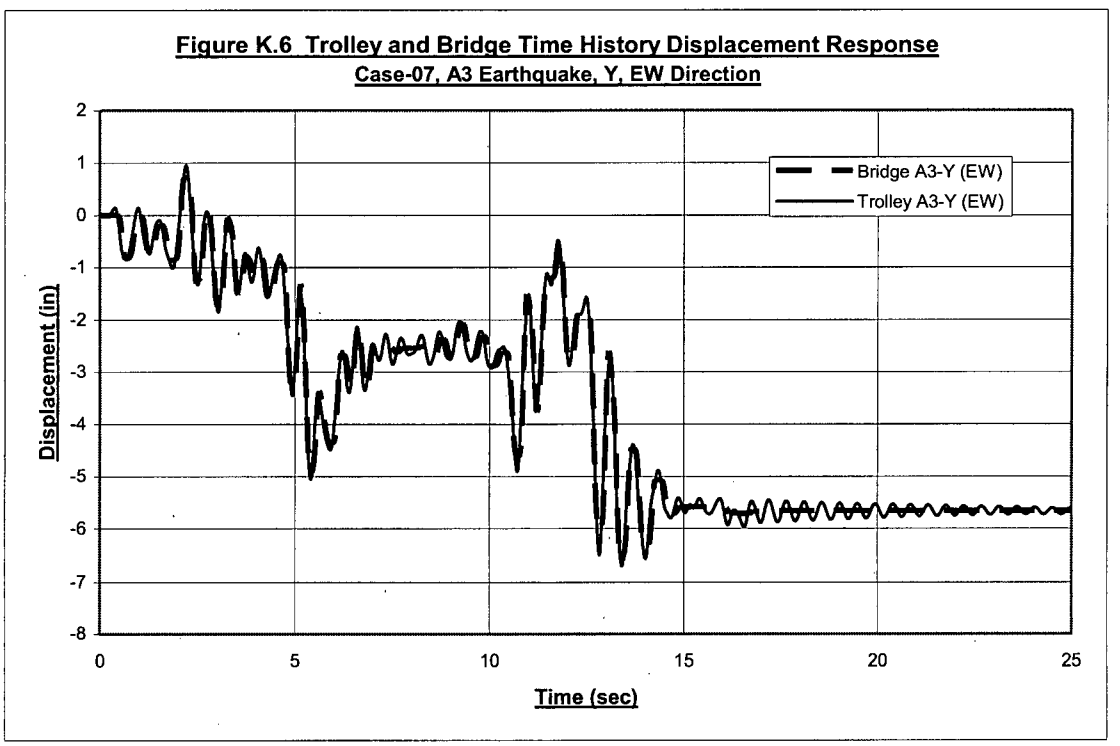

## K.4 A2 Earthquake, Y, EW Direction



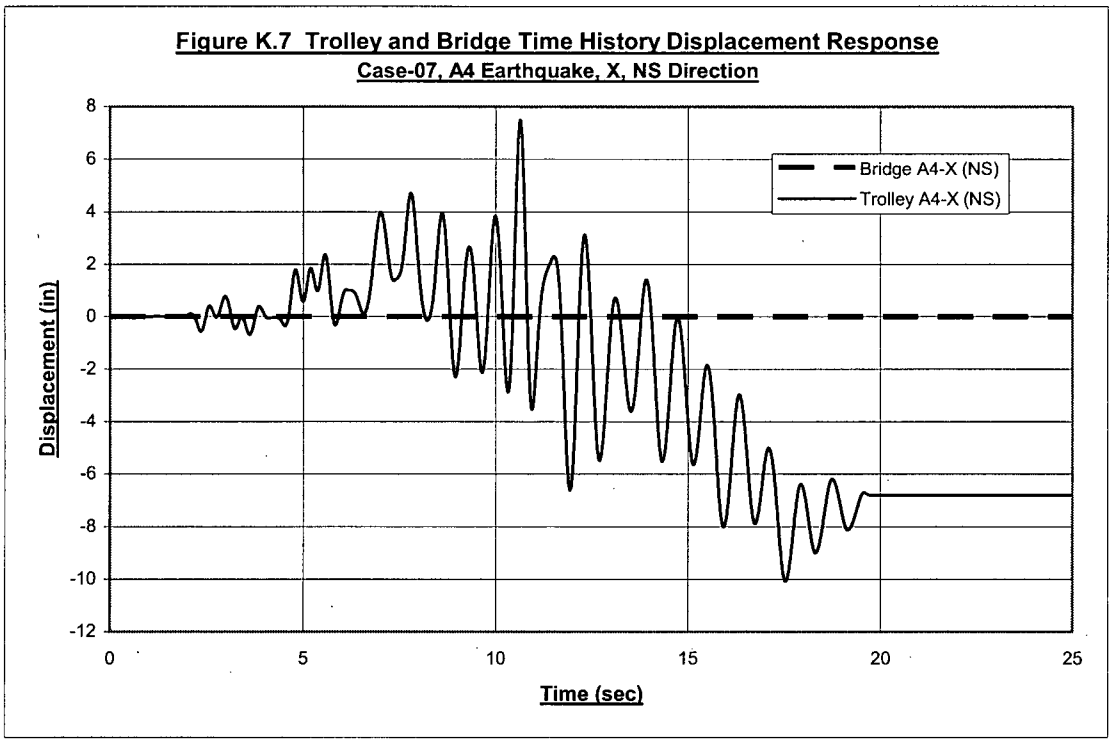
## K.5 A3 Earthquake, X, NS Direction



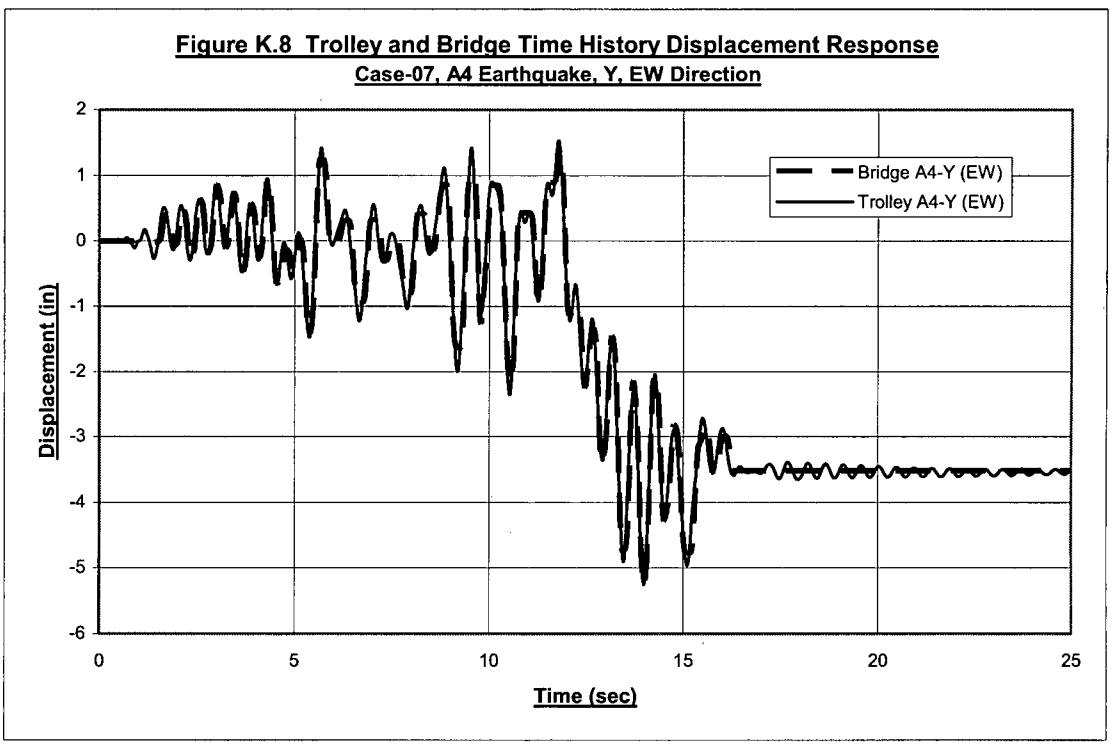

## K.6 A3 Earthquake, Y, EW Direction



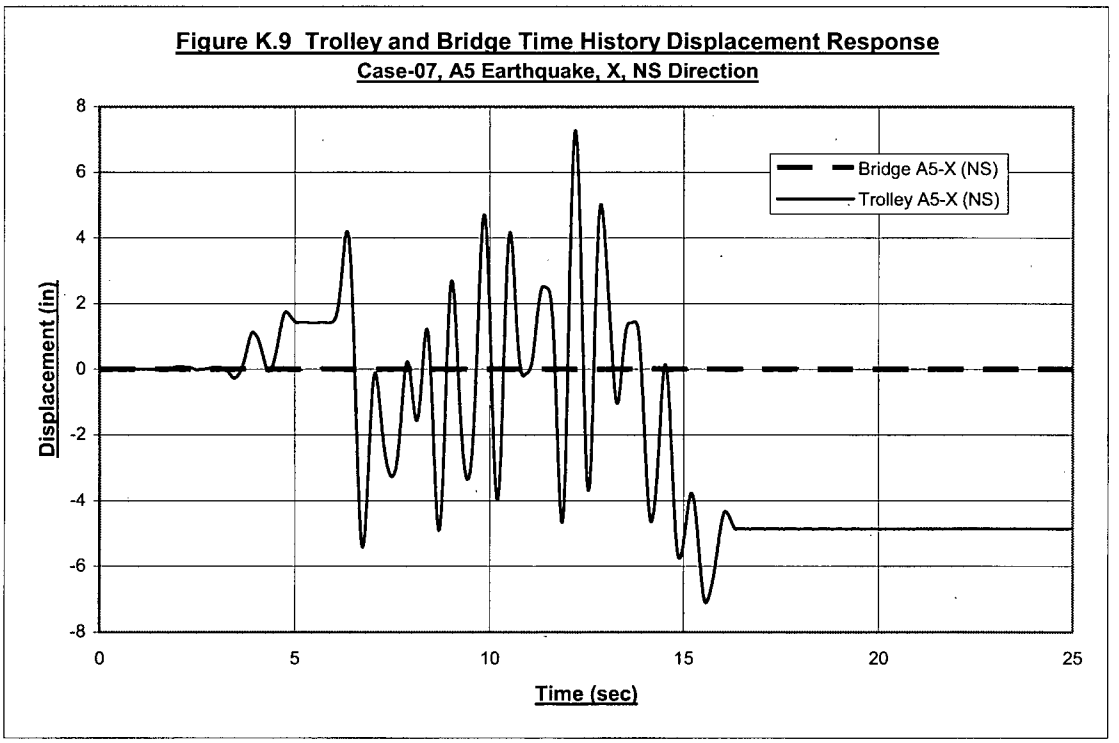
## K.7 A4 Earthquake, X, NS Direction



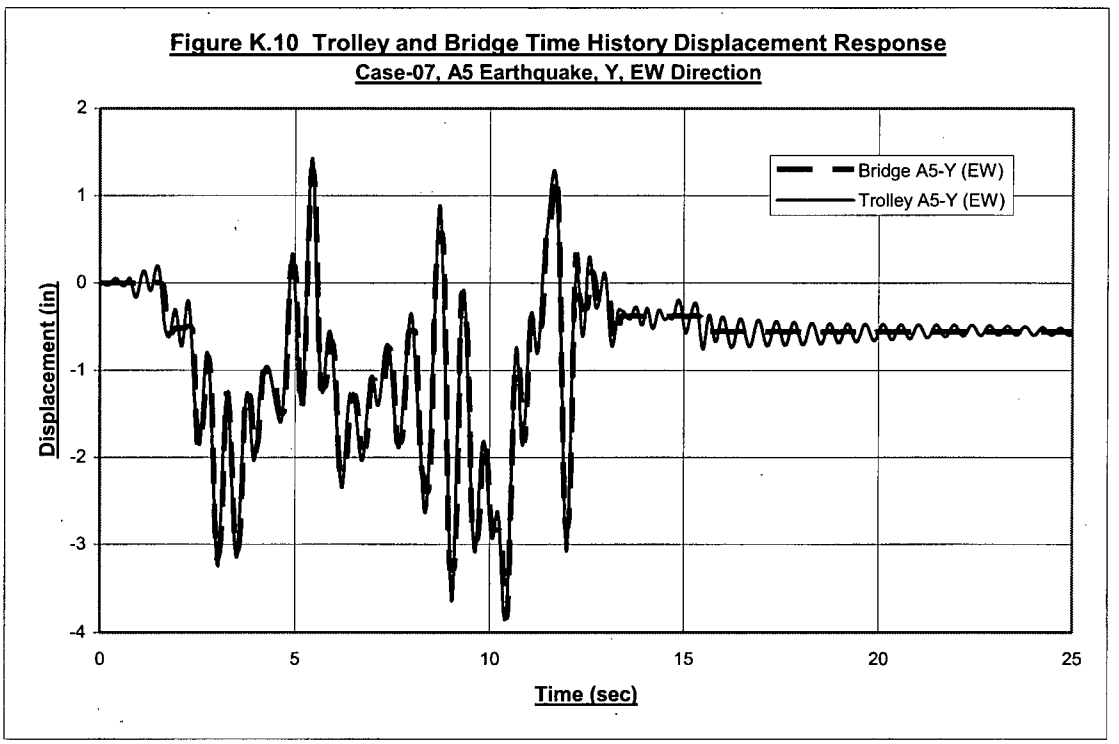

## K.8 A4 Earthquake, Y, EW Direction



## K.9 A5 Earthquake, X, NS Direction




## K.10 A5 Earthquake, Y, EW Direction



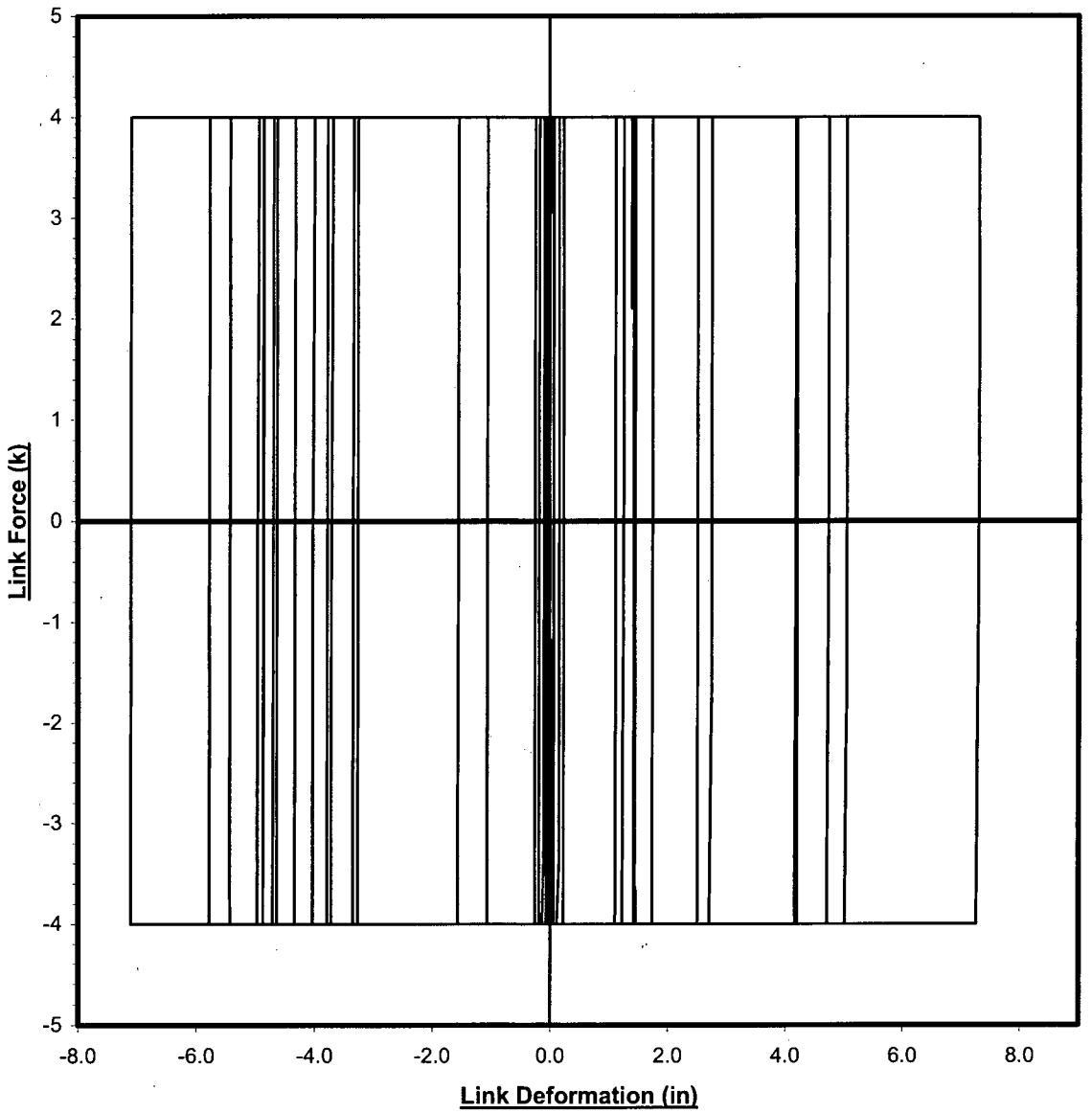
## CAL-20776-SE-007

## NONLINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT L
## TROLLEY NONLINEAR LINK HYSTERESIS RESPONSE LOOP

This hysteresis loop is presented for information purposes. It demonstrates the SAP2000 non-linear link element is correctly used. The time history hysteresis loop (Force-Displacement) shown here is for the trolley nonlinear link element "TR1," and for the "A5" earthquake time history set, and for the "Case07" crane configuration.

**Figure L.1 Trolley Non-Linear Link "TR1 " Hysteresis Curve**
**Load Case-07, Trolley at Mid-Span, A5 Time History Set**



## L.1 Hysteresis Loop Force-Displacement Time History

SAP2000 v11.0.1 File: CASE07_V8_V9_V11 Kip, in, F Units PAGE 1
9/2/08 14:46:59

CASE07 KEWAUNEE 3D MODEL NON-LINEAR TIME HISTORY ANALYSES

TIME HISTORY DATA

CASE A5
FUNCTION LinkTR1-1: Link TR1 U2
FUNCTION LinkTR1: Link TR1 at End-I Shear 2-2

| Time | Displ. (in) | Force (k) | 0.37 | -5.73E-04 | -0.28633 | 0.75 | -0.00119 | -0.59699 |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0.38 | -7.68E-04 | -0.38386 | 0.76 | -0.00139 | -0.69253 |
| 0.01 | -6.75E-06 | -0.00338 | 0.39 | -7.72E-04 | -0.38604 | 0.77 | -0.0013 | -0.65039 |
| 0.02 | -6.28E-05 | -3.14E-02 | 0.4 | -5.97E-04 | -0.29852 | 0.78 | -9.64E-04 | -0.48174 |
| 0.03 | -1.71E-04 | -0.08547 | 0.41 | -3.14E-04 | -0.15693 | 0.79 | -4.92E-04 | -0.24584 |
| 0.04 | -2.30E-04 | -0.11483 | 0.42 | -7.51E-06 | -0.00376 | 0.8 | -4.84E-05 | -0.02418 |
| 0.05 | -1.45E-04 | -0.0726 | 0.43 | 2.57E-04 | 0.12826 | 0.81 | 2.38E-04 | 0.11907 |
| 0.06 | 4.76E-05 | 0.02378 | 0.44 | 4.23E-04 | 0.21162 | 0.82 | 3.18E-04 | 0.15914 |
| 0.07 | 2.25E-04 | 0.11257 | 0.45 | 4.44E-04 | 0.22203 | 0.83 | 2.08E-04 | 0.10391 |
| 0.08 | 3.11E-04 | 0.15569 | 0.46 | 3.03E-04 | 0.15137 | 0.84 | -3.94E-05 | -0.01969 |
| 0.09 | 3.24E-04 | 0.16194 | 0.47 | 4.31E-05 | 0.02154 | 0.85 | -3.26E-04 | -0.16301 |
| 0.1 | 2.93E-04 | 0.14631 | 0.48 | -2.44E-04 | -0.12185 | 0.86 | -5.20E-04 | -0.25983 |
| 0.11 | 1.97E-04 | 0.09841 | 0.49 | -4.62E-04 | -0.23092 | 0.87 | -5.05E-04 | -0.2524 |
| 0.12 | 1.83E-05 | 0.00916 | 0.5 | -5.63E-04 | -0.28146 | 0.88 | -2.48E-04 | -0.12388 |
| 0.13 | -1.73E-04 | -0.08626 | 0.51 | -5.49E-04 | -0.27427 | 0.89 | 1.94E-04 | 0.09687 |
| 0.14 | -2.38E-04 | -0.119 | 0.52 | -4.29E-04 | -0.21454 | 0.9 | 7.18E-04 | 0.35892 |
| 0.15 | -8.96E-05 | -0.0448 | 0.53 | -2.12E-04 | -0.10573 | 0.91 | 0.00122 | 0.60858 |
| 0.16 | 2.41E-04 | 0.12025 | 0.54 | 6.60E-05 | 0.033 | 0.92 | 0.00158 | 0.79191 |
| 0.17 | 6.48E-04 | 0.32393 | 0.55 | 3.25E-04 | 0.16252 | 0.93 | 0.00171 | 0.85683 |
| 0.18 | 1.05E-03 | 0.52576 | 0.56 | 4.86E-04 | 0.24313 | 0.94 | 0.00154 | 0.77159 |
| 0.19 | 1.41E-03 | 0.70298 | 0.57 | 5.21E-04 | 0.26032 | 0.95 | 0.00108 | 0.53987 |
| 0.2 | 0.00164 | 0.82236 | 0.58 | 4.51E-04 | 0.22535 | 0.96 | 4.16E-04 | 0.20784 |
| 0.21 | 0.00168 | 0.83801 | 0.59 | 3.09E-04 | 0.15453 | 0.97 | -3.01E-04 | -0.1506 |
| 0.22 | 0.00146 | 0.73119 | 0.6 | 1.27E-04 | 0.0637 | 0.98 | -9.25E-04 | -0.46263 |
| 0.23 | 0.00108 | 0.54051 | 0.61 | -4.71E-05 | -0.02356 | 0.99 | -0.00134 | -0.67202 |
| 0.24 | 6.72E-04 | 0.33585 | 0.62 | -1.47E-04 | -0.07327 | 1 | -0.00148 | -0.74144 |
| 0.25 | 3.37E-04 | 0.16834 | 0.63 | -1.12E-04 | -0.056 | 1.01 | -0.00132 | -0.6586 |
| 0.26 | 1.18E-04 | 0.05904 | 0.64 | 6.77E-05 | 0.03382 | 1.02 | -8.96E-04 | -0.44775 |
| 0.27 | 3.84E-05 | 0.01918 | 0.65 | 3.46E-04 | 0.17298 | 1.03 | -3.48E-04 | -0.17393 |
| 0.28 | 1.17E-04 | 0.05865 | 0.66 | 6.51E-04 | 0.32545 | 1.04 | 1.48E-04 | 0.07406 |
| 0.29 | 3.39E-04 | 0.16957 | 0.67 | 9.26E-04 | 0.46289 | 1.05 | 4.37E-04 | 0.21831 |
| 0.3 | 6.16E-04 | 0.30799 | 0.68 | 0.00113 | 0.56368 | 1.06 | 4.29E-04 | 0.21423 |
| 0.31 | 8.16E-04 | 0.40784 | 0.69 | 0.0012 | 0.60124 | 1.07 | 1.05E-04 | 0.05227 |
| 0.32 | 8.47E-04 | 0.42366 | 0.7 | 0.00109 | 0.54616 | 1.08 | -4.85E-04 | -0.24244 |
| 0.33 | 7.04E-04 | 0.3518 | 0.71 | 7.72E-04 | 0.38595 | 1.09 | -0.00122 | -0.61143 |
| 0.34 | 4.37E-04 | 0.2186 | 0.72 | 2.89E-04 | 0.14444 | 1.1 | -0.00195 | -0.97364 |
| 0.35 | 1.05E-04 | 0.05267 | 0.73 | -2.64E-04 | -0.13191 | 1.11 | -0.00248 | -1.24014 |
| 0.36 | -2.51E-04 | -0.12564 | 0.74 | -7.90E-04 | -0.3951 | 1.12 | -0.00267 | -1.33725 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1.13 | -0.00247 | -1.23486 | 1.66 | 3.04E-04 | 0.15212 | 2.19 | 0.05422 | -3.99941 |
| 1.14 | -0.00191 | -0.95403 | 1.67 | 5.92E-04 | 0.296 | 2.2 | 0.05204 | -4 |
| 1.15 | -0.00111 | -0.55731 | 1.68 | 8.27E-04 | 0.4137 | 2.21 | 0.05233 | -3.81369 |
| 1.16 | -2.66E-04 | -0.13278 | 1.69 | 9.36E-04 | 0.46839 | 2.22 | 0.05373 | -3.11453 |
| 1.17 | 4.56E-04 | 0.22792 | 1.7 | 9.47E-04 | 0.47368 | 2.23 | 0.05379 | -3.08465 |
| 1.18 | 9.06E-04 | 0.45317 | 1.71 | 0.00104 | 0.52269 | 2.24 | 0.05251 | -3.68813 |
| 1.19 | 0.00102 | 0.50924 | 1.72 | 0.00125 | 0.62557 | 2.25 | 0.05219 | -3.76346 |
| 1.2 | 8.15E-04 | 0.40745 | 1.73 | 0.00134 | 0.66899 | 2.26 | 0.05349 | -3.11208 |
| 1.21 | 3.86E-04 | 0.1928 | 1.74 | 0.00138 | 0.69145 | 2.27 | 0.05516 | -2.27586 |
| 1.22 | -1.65E-04 | -0.08262 | 1.75 | 0.00161 | 0.80662 | 2.28 | 0.05544 | -2.13758 |
| 1.23 | -7.57E-04 | -0.37846 | 1.76 | 0.00227 | 1.13673 | 2.29 | 0.05362 | -3.04828 |
| 1.24 | -0.00132 | -0.6587 | 1.77 | 0.00438 | 2.19067 | 2.3 | 0.05263 | -3.52869 |
| 1.25 | -0.00175 | -0.87536 | 1.78 | 0.00502 | 2.51003 | 2.31 | 0.05251 | -3.57732 |
| 1.26 | -0.00196 | -0.98001 | 1.79 | 0.00336 | 1.67805 | 2.32 | 0.05115 | -3.95846 |
| 1.27 | -0.00192 | -0.96169 | 1.8 | 0.00129 | 0.64372 | 2.33 | 0.04885 | -3.99985 |
| 1.28 | -0.00172 | -0.862 | 1.81 | 0.0018 | 0.89818 | 2.34 | 0.05009 | -3.37059 |
| 1.29 | -0.0015 | -0.75139 | 1.82 | 0.00375 | 1.87748 | 2.35 | 0.04923 | -3.74801 |
| 1.3 | -0.00137 | -0.68548 | 1.83 | 0.00703 | 3.50463 | 2.36 | 0.04811 | -3.97201 |
| 1.31 | -0.00139 | -0.6961 | 1.84 | 0.01255 | 4 | 2.37 | 0.04435 | -4 |
| 1.32 | -0.00162 | -0.80844 | 1.85 | 0.01712 | 4 | 2.38 | 0.04032 | -4 |
| 1.33 | -0.00208 | -1.03965 | 1.86 | 0.01627 | 3.56127 | 2.39 | 0.03445 | -4 |
| 1.34 | -0.00276 | -1.37946 | 1.87 | 0.01524 | 3.04844 | 2.4 | 0.02974 | -4 |
| 1.35 | -0.00355 | -1.77548 | 1.88 | 0.01785 | 3.97002 | 2.41 | 0.02429 | -4 |
| 1.36 | -0.0043 | -2.15157 | 1.89 | 0.02517 | 4 | 2.42 | 0.0187 | -4 |
| 1.37 | -0.0049 | -2.45124 | 1.9 | 0.03202 | 4 | 2.43 | 0.01106 | -4 |
| 1.38 | -0.00531 | -2.65248 | 1.91 | 0.03988 | 4 | 2.44 | 0.00303 | -4 |
| 1.39 | -0.0055 | -2.74959 | 1.92 | 0.04291 | 4 | 2.45 | -0.00638 | -4 |
| 1.4 | -0.00549 | -2.74255 | 1.93 | 0.04511 | 4 | 2.46 | -0.01416 | -4 |
| 1.41 | -0.00529 | -2.64583 | 1.94 | 0.04602 | 4 | 2.47 | -0.01971 | -4 |
| 1.42 | -0.005 | -2.49984 | 1.95 | 0.05203 | 4 | 2.48 | -0.02272 | -4 |
| 1.43 | -0.00473 | -2.36468 | 1.96 | 0.05885 | 4 | 2.49 | -0.02495 | -4 |
| 1.44 | -0.00458 | -2.28774 | 1.97 | 0.06659 | 4 | 2.5 | -0.02616 | -4 |
| 1.45 | -0.00457 | -2.28664 | 1.98 | 0.07159 | 4 | 2.51 | -0.02616 | -3.84342 |
| 1.46 | -0.00472 | -2.35944 | 1.99 | 0.07207 | 3.76993 | 2.52 | -0.02479 | -3.16102 |
| 1.47 | -0.00499 | -2.49299 | 2 | 0.072 | 3.71549 | 2.53 | -0.02096 | -1.24239 |
| 1.48 | -0.00531 | -2.6566 | 2.01 | 0.07132 | 3.3748 | 2.54 | -0.01727 | 0.59883 |
| 1.49 | -0.00559 | -2.7973 | 2.02 | 0.0715 | 3.45685 | 2.55 | -0.01529 | 1.58996 |
| 1.5 | -0.0057 | -2.84755 | 2.03 | 0.07147 | 3.44224 | 2.56 | -0.0159 | 1.28695 |
| 1.51 | -0.00551 | -2.75312 | 2.04 | 0.06881 | 2.10876 | 2.57 | -0.01702 | 0.72399 |
| 1.52 | -0.00501 | -2.50246 | 2.05 | 0.066 | 0.70671 | 2.58 | -0.01645 | 1.01274 |
| 1.53 | -0.00425 | -2.12526 | 2.06 | 0.06533 | 0.37035 | 2.59 | -0.01682 | 0.82703 |
| 1.54 | -0.00333 | -1.66433 | 2.07 | 0.06555 | 0.48116 | 2.6 | -0.01836 | 0.05347 |
| 1.55 | -0.00234 | -1.17153 | 2.08 | 0.06561 | 0.51026 | 2.61 | -0.02074 | -1.13541 |
| 1.56 | -0.00141 | -0.70259 | 2.09 | 0.06497 | 0.19212 | 2.62 | -0.02342 | -2.47593 |
| 1.57 | -6.33E-04 | -0.3162 | 2.1 | 0.06386 | -0.3633 | 2.63 | -0.02342 | -2.4718 |
| 1.58 | -1.13E-04 | -0.05645 | 2.11 | 0.06426 | -0.16426 | 2.64 | -0.02236 | -1.94265 |
| 1.59 | 1.68E-04 | 0.08404 | 2.12 | 0.066 | 0.70351 | 2.65 | -0.01913 | -0.32845 |
| 1.6 | 2.19E-04 | 0.10982 | 2.13 | 0.06681 | 1.11053 | 2.66 | -0.01592 | 1.27532 |
| 1.61 | 1.69E-04 | 0.08485 | 2.14 | 0.06649 | 0.94816 | 2.67 | -0.01604 | 1.21784 |
| 1.62 | 1.45E-04 | 0.07261 | 2.15 | 0.065 | 0.2065 | 2.68 | -0.01709 | 0.69163 |
| 1.63 | 3.26E-05 | 0.0165 | 2.16 | 0.06276 | -0.91349 | 2.69 | -0.01405 | 2.21231 |
| 1.64 | -6.12E-05 | -0.03037 | 2.17 | 0.06028 | -2.15603 | 2.7 | -0.0109 | 3.73414 |
| 1.65 | 6.52E-05 | 0.03282 | 2.18 | 0.05748 | -3.54132 | 2.71 | -0.00444 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.72 | -4.10E-04 | 4 | 3.25 | -0.03235 | -4 | 3.78 | 0.6417 | 4 |
| 2.73 | 0.00106 | 3.99913 | 3.26 | -0.04012 | -4 | 3.79 | 0.69518 | 4 |
| 2.74 | 0.00194 | 3.99843 | 3.27 | -0.04737 | -4 | 3.8 | 0.7503 | 4 |
| 2.75 | 0.00399 | 3.99999 | 3.28 | -0.05723 | -4 | 3.81 | 0.80513 | 4 |
| 2.76 | 0.00781 | 4 | 3.29 | -0.0759 | -4 | 3.82 | 0.85691 | 4 |
| 2.77 | 0.01264 | 4 | 3.3 | -0.0892 | -4 | 3.83 | 0.90424 | 4 |
| 2.78 | 0.01711 | 4 | 3.31 | -0.10426 | -4 | 3.84 | 0.94141 | 4 |
| 2.79 | 0.01833 | 3.4519 | 3.32 | -0.11384 | -4 | 3.85 | 0.97891 | 4 |
| 2.8 | 0.01902 | 3.74362 | 3.33 | -0.12508 | -4 | 3.86 | 1.01526 | 4 |
| 2.81 | 0.02376 | 4 | 3.34 | -0.13906 | -4 | 3.87 | 1.05249 | 4 |
| 2.82 | 0.03258 | 4 | 3.35 | -0.15737 | -4 | 3.88 | 1.07916 | 4 |
| 2.83 | 0.03914 | 4 | 3.36 | -0.16997 | -4 | 3.89 | 1.10116 | 4 |
| 2.84 | 0.0452 | 4 | 3.37 | -0.18393 | -4 | 3.9 | 1.1133 | 4 |
| 2.85 | 0.04492 | 3.7136 | 3.38 | -0.19742 | -4 | 3.91 | 1.12042 | 4 |
| 2.86 | 0.04576 | 3.93518 | 3.39 | -0.21339 | -4 | 3.92 | 1.12259 | 4 |
| 2.87 | 0.05242 | 4 | 3.4 | -0.22516 | -4 | 3.93 | 1.12189 | 3.60714 |
| 2.88 | 0.06121 | 4 | 3.41 | -0.23809 | -4 | 3.94 | 1.11555 | 0.43538 |
| 2.89 | 0.06598 | 4 | 3.42 | -0.24549 | -4 | 3.95 | 1.10663 | -3.86758 |
| 2.9 | 0.06407 | 3.04808 | 3.43 | -0.25234 | -4 | 3.96 | 1.09662 | -4 |
| 2.91 | 0.06344 | 2.73188 | 3.44 | -0.25676 | -4 | 3.97 | 1.08248 | -4 |
| 2.92 | 0.06381 | 2.91817 | 3.45 | -0.25984 | -4 | 3.98 | 1.06664 | -4 |
| 2.93 | 0.06576 | 3.80484 | 3.46 | -0.25759 | -2.87207 | 3.99 | 1.05191 | -4 |
| 2.94 | 0.06905 | 3.99988 | 3.47 | -0.252 | -0.07588 | 4 | 1.03708 | -4 |
| 2.95 | 0.06616 | 2.55594 | 3.48 | -0.24542 | 3.20906 | 4.01 | 1.02027 | -4 |
| 2.96 | 0.06351 | 1.2273 | 3.49 | -0.23818 | 4 | 4.02 | 1.00012 | -4 |
| 2.97 | 0.06246 | 0.70256 | 3.5 | -0.23052 | 4 | 4.03 | 0.97367 | -4 |
| 2.98 | 0.06321 | 1.07953 | 3.51 | -0.22342 | 4 | 4.04 | 0.94933 | -4 |
| 2.99 | 0.06418 | 1.56232 | 3.52 | -0.21152 | 4 | 4.05 | 0.92408 | -4 |
| 3 | 0.06332 | 1.13552 | 3.53 | -0.20025 | 4 | 4.06 | 0.90013 | -4 |
| 3.01 | 0.06078 | -0.1354 | 3.54 | -0.18478 | 4 | 4.07 | 0.87318 | -4 |
| 3.02 | 0.05979 | -0.62889 | 3.55 | -0.17589 | 4 | 4.08 | 0.8406 | -4 |
| 3.03 | 0.06174 | 0.34307 | 3.56 | -0.16454 | 4 | 4.09 | 0.80304 | -4 |
| 3.04 | 0.06367 | 1.30879 | 3.57 | -0.15347 | 4 | 4.1 | 0.76513 | -4 |
| 3.05 | 0.06079 | -0.12852 | 3.58 | -0.13621 | 4 | 4.11 | 0.73059 | -4 |
| 3.06 | 0.05629 | -2.38291 | 3.59 | -0.11413 | 4 | 4.12 | 0.69492 | -4 |
| 3.07 | 0.05536 | -2.84498 | 3.6 | -0.08999 | 4 | 4.13 | 0.65565 | -4 |
| 3.08 | 0.05582 | -2.61359 | 3.61 | -0.06881 | 4 | 4.14 | 0.61145 | -4 |
| 3.09 | 0.05621 | -2.42149 | 3.62 | -0.04449 | 4 | 4.15 | 0.56397 | -4 |
| 3.1 | 0.05466 | -3.19239 | 3.63 | -0.01633 | 4 | 4.16 | 0.51703 | -4 |
| 3.11 | 0.04837 | -4 | 3.64 | 0.01722 | 4 | 4.17 | 0.47234 | -4 |
| 3.12 | 0.04011 | -4 | 3.65 | 0.0512 | 4 | 4.18 | 0.42701 | -4 |
| 3.13 | 0.03317 | -4 | 3.66 | 0.08841 | 4 | 4.19 | 0.37862 | -4 |
| 3.14 | 0.03069 | -4 | 3.67 | 0.1253 | 4 | 4.2 | 0.32826 | -4 |
| 3.15 | 0.02843 | -4 | 3.68 | 0.16504 | 4 | 4.21 | 0.27859 | -4 |
| 3.16 | 0.02414 | -4 | 3.69 | 0.20707 | 4 | 4.22 | 0.23015 | -4 |
| 3.17 | 0.01525 | -4 | 3.7 | 0.25076 | 4 | 4.23 | 0.18818 | -4 |
| 3.18 | 0.00429 | -4 | 3.71 | 0.29546 | 4 | 4.24 | 0.14561 | -4 |
| 3.19 | 0.00303 | -3.25834 | 3.72 | 0.3423 | 4 | 4.25 | 0.10586 | -4 |
| 3.2 | 0.00446 | -2.53893 | 3.73 | 0.38988 | 4 | 4.26 | 0.06745 | -4 |
| 3.21 | 0.00718 | -1.18159 | 3.74 | 0.43721 | 4 | 4.27 | 0.0338 | -4 |
| 3.22 | 0.00143 | -3.88425 | 3.75 | 0.48628 | 4 | 4.28 | 0.00247 | -4 |
| 3.23 | -0.00818 | -4 | 3.76 | 0.53745 | 4 | 4.29 | -0.02426 | -4 |
| 3.24 | -0.02294 | -4 | 3.77 | 0.59051 | 4 | 4.3 | -0.0449 | -4 |

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|---|---|---|---|---|---|---|---|---|
| 4.31 | -0.0559 | -4 | 4.84 | 1.69222 | -4 | 5.37 | 1.42093 | -3.99999 |
| 4.32 | -0.06326 | -4 | 4.85 | 1.67706 | -4 | 5.38 | 1.41872 | -3.78792 |
| 4.33 | -0.06639 | -4 | 4.86 | 1.66482 | -4 | 5.39 | 1.41999 | -3.15398 |
| 4.34 | -0.0623 | -1.95501 | 4.87 | 1.65173 | -4 | 5.4 | 1.42217 | -2.05925 |
| 4.35 | -0.05621 | 1.08941 | 4.88 | 1.63465 | -4 | 5.41 | 1.42179 | -2.25181 |
| 4.36 | -0.04941 | 3.98394 | 4.89 | 1.61369 | -4 | 5.42 | 1.42081 | -2.7391 |
| 4.37 | -0.03982 | 4 | 4.9 | 1.59347 | -4 | 5.43 | 1.42048 | -2.90163 |
| 4.38 | -0.02279 | 4 | 4.91 | 1.57567 | -4 | 5.44 | 1.42308 | -1.606 |
| 4.39 | 0.00108 | 4 | 4.92 | 1.55818 | -4 | 5.45 | 1.42576 | -0.26437 |
| 4.4 | 0.02503 | 4 | 4.93 | 1.54343 | -4 | 5.46 | 1.42924 | 1.47393 |
| 4.41 | 0.04657 | 4 | 4.94 | 1.52783 | -4 | 5.47 | 1.43022 | 1.96388 |
| 4.42 | 0.06883 | 4 | 4.95 | 1.51802 | -4 | 5.48 | 1.4262 | -0.04622 |
| 4.43 | 0.09646 | 4 | 4.96 | 1.50795 | -4 | 5.49 | 1.42356 | -1.36147 |
| 4.44 | 0.13356 | 4 | 4.97 | 1.50102 | -4 | 5.5 | 1.42368 | -1.30474 |
| 4.45 | 0.17556 | 4 | 4.98 | 1.48796 | -4 | 5.51 | 1.42484 | -0.72465 |
| 4.46 | 0.21797 | 4 | 4.99 | 1.473 | -4 | 5.52 | 1.42706 | 0.38366 |
| 4.47 | 0.2585 | 4 | 5 | 1.45666 | -4 | 5.53 | 1.42476 | -0.76236 |
| 4.48 | 0.30082 | 4 | 5.01 | 1.45129 | -4 | 5.54 | 1.42203 | -2.12751 |
| 4.49 | 0.35009 | 4 | 5.02 | 1.45014 | -4 | 5.55 | 1.41968 | -3.29933 |
| 4.5 | 0.40715 | 4 | 5.03 | 1.45085 | -3.63474 | 5.56 | 1.42178 | -2.25009 |
| 4.51 | 0.4662 | 4 | 5.04 | 1.44469 | -4 | 5.57 | 1.42626 | -0.00884 |
| 4.52 | 0.52342 | 4 | 5.05 | 1.4364 | -4 | 5.58 | 1.42624 | -0.02168 |
| 4.53 | 0.58033 | 4 | 5.06 | 1.42706 | -4 | 5.59 | 1.42389 | -1.19544 |
| 4.54 | 0.64033 | 4 | 5.07 | 1.42528 | -3.86646 | 5.6 | 1.42162 | -2.33154 |
| 4.55 | 0.70554 | 4 | 5.08 | 1.42949 | -1.76341 | 5.61 | 1.4193 | -3.48097 |
| 4.56 | 0.77427 | 4 | 5.09 | 1.43311 | 0.04761 | 5.62 | 1.42272 | -1.77008 |
| 4.57 | 0.84227 | 4 | 5.1 | 1.4328 | -0.10893 | 5.63 | 1.42651 | 0.12542 |
| 4.58 | 0.90809 | 4 | 5.11 | 1.43061 | -1.20312 | 5.64 | 1.4262 | -0.02684 |
| 4.59 | 0.97401 | 4 | 5.12 | 1.43021 | -1.39961 | 5.65 | 1.4243 | -0.97765 |
| 4.6 | 1.04129 | 4 | 5.13 | 1.43227 | -0.37027 | 5.66 | 1.42273 | -1.76581 |
| 4.61 | 1.10986 | 4 | 5.14 | 1.43422 | 0.60182 | 5.67 | 1.42597 | -0.14246 |
| 4.62 | 1.17762 | 4 | 5.15 | 1.43249 | -0.26053 | 5.68 | 1.43096 | 2.34894 |
| 4.63 | 1.24395 | 4 | 5.16 | 1.42907 | -1.97273 | 5.69 | 1.43478 | 3.95382 |
| 4.64 | 1.30279 | 4 | 5.17 | 1.42934 | -1.83566 | 5.7 | 1.43355 | 3.26002 |
| 4.65 | 1.3564 | 4 | 5.18 | 1.42927 | -1.87037 | 5.71 | 1.43072 | 1.84634 |
| 4.66 | 1.40826 | 4 | 5.19 | 1.4292 | -1.90392 | 5.72 | 1.42924 | 1.10752 |
| 4.67 | 1.46199 | 4 | 5.2 | 1.42791 | -2.55072 | 5.73 | 1.42839 | 0.68037 |
| 4.68 | 1.51243 | 4 | 5.21 | 1.42601 | -3.48708 | 5.74 | 1.42851 | 0.73904 |
| 4.69 | 1.5603 | 4 | 5.22 | 1.42856 | -2.21579 | 5.75 | 1.42773 | 0.34954 |
| 4.7 | 1.60456 | 4 | 5.23 | 1.43217 | -0.40859 | 5.76 | 1.42776 | 0.36707 |
| 4.71 | 1.64273 | 4 | 5.24 | 1.43316 | 0.08761 | 5.77 | 1.4289 | 0.93782 |
| 4.72 | 1.67374 | 4 | 5.25 | 1.43187 | -0.5576 | 5.78 | 1.42666 | -0.18602 |
| 4.73 | 1.69693 | 4 | 5.26 | 1.42998 | -1.50611 | 5.79 | 1.42202 | -2.50344 |
| 4.74 | 1.71611 | 4 | 5.27 | 1.4289 | -2.04224 | 5.8 | 1.42336 | -1.83562 |
| 4.75 | 1.73178 | 4 | 5.28 | 1.43233 | -0.33187 | 5.81 | 1.42677 | -0.13129 |
| 4.76 | 1.74478 | 4 | 5.29 | 1.4349 | 0.95361 | 5.82 | 1.42718 | 0.07583 |
| 4.77 | 1.75227 | 4 | 5.3 | 1.43243 | -0.27802 | 5.83 | 1.42603 | -0.50049 |
| 4.78 | 1.75159 | 3.26081 | 5.31 | 1.43074 | -1.12484 | 5.84 | 1.42295 | -2.04007 |
| 4.79 | 1.74441 | -0.3273 | 5.32 | 1.42982 | -1.58519 | 5.85 | 1.42118 | -2.92395 |
| 4.8 | 1.73579 | -3.99028 | 5.33 | 1.43091 | -1.04164 | 5.86 | 1.42412 | -1.45388 |
| 4.81 | 1.72847 | -4 | 5.34 | 1.43396 | 0.48582 | 5.87 | 1.42619 | -0.4182 |
| 4.82 | 1.7202 | -4 | 5.35 | 1.43236 | -0.31296 | 5.88 | 1.42351 | -1.7593 |
| 4.83 | 1.7072 | -4 | 5.36 | 1.42638 | -3.30104 | 5.89 | 1.42137 | -2.82725 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5.9 | 1.42256 | -2.23284 | 6.43 | 3.2819 | -4 | 6.96 | -1.14905 | 4 |
| 5.91 | 1.4262 | -0.41398 | 6.44 | 3.05918 | -4 | 6.97 | -0.95264 | 4 |
| 5.92 | 1.4311 | 2.03849 | 6.45 | 2.81585 | -4 | 6.98 | -0.77561 | 4 |
| 5.93 | 1.43305 | 3.0085 | 6.46 | 2.54911 | -4 | 6.99 | -0.61295 | 4 |
| 5.94 | 1.43393 | 3.44253 | 6.47 | 2.26411 | -4 | 7 | -0.47225 | 4 |
| 5.95 | 1.43656 | 3.99578 | 6.48 | 1.96265 | -4 | 7.01 | -0.35136 | 4 |
| 5.96 | 1.44526 | 4 | 6.49 | 1.64489 | -4 | 7.02 | -0.25005 | 4 |
| 5.97 | 1.45777 | 4 | 6.5 | 1.31153 | -4 | 7.03 | -0.17258 | 4 |
| 5.98 | 1.46686 | 4 | 6.51 | 0.96028 | -4 | 7.04 | -0.12208 | 4 |
| 5.99 | 1.47491 | 4 | 6.52 | 0.59715 | -4 | 7.05 | -0.09612 | 4 |
| 6 | 1.48038 | 4 | 6.53 | 0.21974 | -4 | 7.06 | -0.09464 | 3.473 |
| 6.01 | 1.48989 | 4 | 6.54 | -0.16771 | -4 | 7.07 | -0.1082 | -3.30543 |
| 6.02 | 1.50886 | 4 | 6.55 | -0.55985 | -4 | 7.08 | -0.13708 | -4 |
| 6.03 | 1.53599 | 4 | 6.56 | -0.94921 | -4 | 7.09 | -0.18015 | -4 |
| 6.04 | 1.56358 | 4 | 6.57 | -1.33547 | -4 | 7.1 | -0.24532 | -4 |
| 6.05 | 1.5912 | 4 | 6.58 | -1.72301 | -4 | 7.11 | -0.32608 | -4 |
| 6.06 | 1.62212 | 4 | 6.59 | -2.10989 | -4 | 7.12 | -0.41884 | -4 |
| 6.07 | 1.66044 | 4 | 6.6 | -2.49191 | -4 | 7.13 | -0.51936 | -4 |
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| 6.09 | 1.76589 | 4 | 6.62 | -3.21434 | -4 | 7.15 | -0.74242 | -4 |
| 6.1 | 1.83013 | 4 | 6.63 | -3.54378 | -4 | 7.16 | -0.86645 | -4 |
| 6.11 | 1.90014 | 4 | 6.64 | -3.85489 | -4 | 7.17 | -0.99513 | -4 |
| 6.12 | 1.98E+00 | 4 | 6.65 | -4.14923 | -4 | 7.18 | -1.12813 | -4 |
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| 6.3 | 4.07186 | 4 | 6.83 | -4.35417 | 4 | 7.36 | -2.90683 | -4 |
| 6.31 | 4.13655 | 4 | 6.84 | -4.13526 | 4 | 7.37 | -2.95734 | -4 |
| 6.32 | 4.18678 | 4 | 6.85 | -3.89503 | 4 | 7.38 | -3.00362 | -4 |
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| 6.34 | 4.21831 | 3.03058 | 6.87 | -3.38953 | 4 | 7.4 | -3.08853 | -4 |
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|---|---|---|---|---|---|---|---|---|
| 7.49 | -3.26991 | -3.99998 | 8.02 | -0.81933 | -4 | 8.55 | -2.00193 | -4 |
| 7.5 | -3.26363 | -0.8563 | 8.03 | -0.93764 | -4 | 8.56 | -2.31476 | -4 |
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| 7.53 | -3.22606 | 4 | 8.06 | -1.24507 | -4 | 8.59 | -3.21976 | -4 |
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| 7.55 | -3.17358 | 4 | 8.08 | -1.40154 | -4 | 8.61 | -3.77301 | -4 |
| 7.56 | -3.1365 | 4 | 8.09 | -1.46627 | -4 | 8.62 | -4.01884 | -4 |
| 7.57 | -3.10103 | 4 | 8.1 | -1.51921 | -4 | 8.63 | -4.24378 | -4 |
| 7.58 | -3.0592 | 4 | 8.11 | -1.55316 | -4 | 8.64 | -4.44408 | -4 |
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| 7.6 | -2.94913 | 4 | 8.13 | -1.55953 | -0.87361 | 8.66 | -4.75648 | -4 |
| 7.61 | -2.87589 | 4 | 8.14 | -1.54146 | 4 | 8.67 | -4.86259 | -4 |
| 7.62 | -2.79106 | 4 | 8.15 | -1.51405 | 4 | 8.68 | -4.93308 | -4 |
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| 7.64 | -2.60591 | 4 | 8.17 | -1.40133 | 4 | 8.7 | -4.96614 | -1.1911 |
| 7.65 | -2.50158 | 4 | 8.18 | -1.31185 | 4 | 8.71 | -4.92979 | 4 |
| 7.66 | -2.38369 | 4 | 8.19 | -1.2101 | 4 | 8.72 | -4.85966 | 4 |
| 7.67 | -2.25914 | 4 | 8.2 | -1.09933 | 4 | 8.73 | -4.75404 | 4 |
| 7.68 | -2.12706 | 4 | 8.21 | -0.9772 | 4 | 8.74 | -4.61176 | 4 |
| 7.69 | -1.99403 | 4 | 8.22 | -0.83777 | 4 | 8.75 | -4.43774 | 4 |
| 7.7 | -1.85167 | 4 | 8.23 | -0.68302 | 4 | 8.76 | -4.2342 | 4 |
| 7.71 | -1.70185 | 4 | 8.24 | -0.51821 | 4 | 8.77 | -4.01118 | 4 |
| 7.72 | -1.54468 | 4 | 8.25 | -0.35051 | 4 | 8.78 | -3.75597 | 4 |
| 7.73 | -1.38405 | 4 | 8.26 | -0.18012 | 4 | 8.79 | -3.47355 | 4 |
| 7.74 | -1.22884 | 4 | 8.27 | -0.00604 | 4 | 8.8 | -3.16479 | 4 |
| 7.75 | -1.07587 | 4 | 8.28 | 0.17148 | 4 | 8.81 | -2.83995 | 4 |
| 7.76 | -0.92469 | 4 | 8.29 | 0.34551 | 4 | 8.82 | -2.50204 | 4 |
| 7.77 | -0.7701 | 4 | 8.3 | 0.51075 | 4 | 8.83 | -2.1549 | 4 |
| 7.78 | -0.6199 | 4 | 8.31 | 0.66293 | 4 | 8.84 | -1.79355 | 4 |
| 7.79 | -0.47734 | 4 | 8.32 | 0.80469 | 4 | 8.85 | -1.4258 | 4 |
| 7.8 | -0.34508 | 4 | 8.33 | 0.93476 | 4 | 8.86 | -1.05681 | 4 |
| 7.81 | -0.22443 | 4 | 8.34 | 1.05007 | 4 | 8.87 | -0.69263 | 4 |
| 7.82 | -0.11542 | 4 | 8.35 | 1.14249 | 4 | 8.88 | -0.33035 | 4 |
| 7.83 | -0.01632 | 4 | 8.36 | 1.208 | 4 | 8.89 | 0.02643 | 4 |
| 7.84 | 0.0694 | 4 | 8.37 | 1.2461 | 4 | 8.9 | 0.37524 | 4 |
| 7.85 | 0.14 | 4 | 8.38 | 1.26105 | 4 | 8.91 | 0.70864 | 4 |
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| 7.87 | 0.22678 | 4 | 8.4 | 1.22423 | -4 | 8.93 | 1.31531 | 4 |
| 7.88 | 0.24062 | 4 | 8.41 | 1.1653 | -4 | 8.94 | 1.58949 | 4 |
| 7.89 | 0.23845 | 2.44608 | 8.42 | 1.07568 | -4 | 8.95 | 1.84285 | 4 |
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| 7.91 | 0.19147 | -4 | 8.44 | 0.8102 | -4 | 8.97 | 2.26772 | 4 |
| 7.92 | 0.14547 | -4 | 8.45 | 0.64745 | -4 | 8.98 | 2.43147 | 4 |
| 7.93 | 0.08248 | -4 | 8.46 | 0.46588 | -4 | 8.99 | 2.5606 | 4 |
| 7.94 | 0.00684 | -4 | 8.47 | 0.25754 | -4 | 9 | 2.65882 | 4 |
| 7.95 | -0.07838 | -4 | 8.48 | 0.02346 | -4 | 9.01 | 2.72845 | 4 |
| 7.96 | -0.16785 | -4 | 8.49 | -0.23312 | -4 | 9.02 | 2.76299 | 4 |
| 7.97 | -0.26 | -4 | 8.5 | -0.50329 | -4 | 9.03 | 2.75268 | -1.60894 |
| 7.98 | -0.36071 | -4 | 8.51 | -0.78264 | -4 | 9.04 | 2.70322 | -4 |
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| 8.01 | -0.70232 | -4 | 8.54 | -1.68538 | -4 | 9.07 | 2.43108 | -4 |

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|---|---|---|---|---|---|---|---|---|
| 9.08 | 2.29622 | -4 | 9.61 | -1.21667 | 4 | 10.14 | -3.41231 | -4 |
| 9.09 | 2.15032 | -4 | 9.62 | -0.95384 | 4 | 10.15 | -3.60799 | -4 |
| 9.1 | 1.97022 | -4 | 9.63 | -0.67771 | 4 | 10.16 | -3.77101 | -4 |
| 9.11 | 1.77417 | -4 | 9.64 | -0.39344 | 4 | 10.17 | -3.89581 | -4 |
| 9.12 | 1.55375 | -4 | 9.65 | -0.09259 | 4 | 10.18 | -3.98485 | -4 |
| 9.13 | 1.33347 | -4 | 9.66 | 0.21859 | 4 | 10.19 | -4.02973 | -4 |
| 9.14 | 1.10333 | -4 | 9.67 | 0.54072 | 4 | 10.2 | -4.03002 | -0.57957 |
| 9.15 | 0.88029 | -4 | 9.68 | 0.86995 | 4 | 10.21 | -3.98922 | 4 |
| 9.16 | 0.64625 | -4 | 9.69 | 1.19975 | 4 | 10.22 | -3.91289 | 4 |
| 9.17 | 0.40814 | -4 | 9.7 | 1.52559 | 4 | 10.23 | -3.80003 | 4 |
| 9.18 | 0.15792 | -4 | 9.71 | 1.84598 | 4 | 10.24 | -3.6421 | 4 |
| 9.19 | -0.08457 | -4 | 9.72 | 2.16402 | 4 | 10.25 | -3.44717 | 4 |
| 9.2 | -0.32401 | -4 | 9.73 | 2.47838 | 4 | 10.26 | -3.21832 | 4 |
| 9.21 | -0.54905 | -4 | 9.74 | 2.78794 | 4 | 10.27 | -2.96545 | 4 |
| 9.22 | -0.77359 | -4 | 9.75 | 3.08853 | 4 | 10.28 | -2.68246 | 4 |
| 9.23 | -0.99284 | -4 | 9.76 | 3.36902 | 4 | 10.29 | -2.36832 | 4 |
| 9.24 | -1.21423 | -4 | 9.77 | 3.62496 | 4 | 10.3 | -2.02134 | 4 |
| 9.25 | -1.4248 | -4 | 9.78 | 3.85937 | 4 | 10.31 | -1.65634 | 4 |
| 9.26 | -1.63044 | -4 | 9.79 | 4.07416 | 4 | 10.32 | -1.27898 | 4 |
| 9.27 | -1.82375 | -4 | 9.8 | 4.26908 | 4 | 10.33 | -0.89274 | 4 |
| 9.28 | -2.00982 | -4 | 9.81 | 4.43725 | 4 | 10.34 | -0.49337 | 4 |
| 9.29 | -2.1822 | -4 | 9.82 | 4.57122 | 4 | 10.35 | -0.08415 | 4 |
| 9.3 | -2.34955 | -4 | 9.83 | 4.66525 | 4 | 10.36 | 0.32956 | 4 |
| 9.31 | -2.49545 | -4 | 9.84 | 4.72492 | 4 | 10.37 | 0.73474 | 4 |
| 9.32 | -2.63705 | -4 | 9.85 | 4.75217 | 4 | 10.38 | 1.12905 | 4 |
| 9.33 | -2.75748 | -4 | 9.86 | 4.74643 | 0.34966 | 10.39 | 1.51363 | 4 |
| 9.34 | -2.87608 | -4 | 9.87 | 4.71112 | -4 | 10.4 | 1.88924 | 4 |
| 9.35 | -2.97592 | -4 | 9.88 | 4.64382 | -4 | 10.41 | 2.24715 | 4 |
| 9.36 | -3.07035 | -4 | 9.89 | 4.54172 | -4 | 10.42 | 2.58254 | 4 |
| 9.37 | -3.14555 | -4 | 9.9 | 4.40864 | -4 | 10.43 | 2.88931 | 4 |
| 9.38 | -3.21295 | -4 | 9.91 | 4.24124 | -4 | 10.44 | 3.16888 | 4 |
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| 9.4 | -3.3019 | -4 | 9.93 | 3.82478 | -4 | 10.46 | 3.64185 | 4 |
| 9.41 | -3.32765 | -4 | 9.94 | 3.57554 | -4 | 10.47 | 3.82315 | 4 |
| 9.42 | -3.34615 | -4 | 9.95 | 3.29971 | -4 | 10.48 | 3.97026 | 4 |
| 9.43 | -3.34582 | -3.09635 | 9.96 | 3.00062 | -4 | 10.49 | 4.07739 | 4 |
| 9.44 | -3.33936 | 0.13599 | 9.97 | 2.67751 | -4 | 10.5 | 4.15068 | 4 |
| 9.45 | -3.32293 | 4 | 9.98 | 2.33083 | -4 | 10.51 | 4.18937 | 4 |
| 9.46 | -3.29886 | 4 | 9.99 | 1.96455 | -4 | 10.52 | 4.19521 | 2.67273 |
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| 9.48 | -3.20955 | 4 | 10.01 | 1.19248 | -4 | 10.54 | 4.10088 | -4 |
| 9.49 | -3.1468 | 4 | 10.02 | 0.79783 | -4 | 10.55 | 4.01145 | -4 |
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| 9.57 | -2.14145 | 4 | 10.1 | -2.28219 | -4 | 10.63 | 2.60202 | -4 |
| 9.58 | -1.93767 | 4 | 10.11 | -2.60762 | -4 | 10.64 | 2.38029 | -4 |
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| 9.6 | -1.4715 | 4 | 10.13 | -3.17832 | -4 | 10.66 | 1.93449 | -4 |

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|---|---|---|---|---|---|---|---|---|
| 10.67 | 1.71584 | -4 | 11.2 | 1.39733 | 4 | 11.73 | -1.71806 | -4 |
| 10.68 | 1.50647 | -4 | 11.21 | 1.51222 | 4 | 11.74 | -2.06424 | -4 |
| 10.69 | 1.31204 | -4 | 11.22 | 1.6237 | 4 | 11.75 | -2.41403 | -4 |
| 10.7 | 1.12507 | -4 | 11.23 | 1.73086 | 4 | 11.76 | -2.75438 | -4 |
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| 10.82 | -0.11312 | -4 | 11.35 | 2.49607 | 4 | 11.88 | -4.61563 | 4 |
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| 10.86 | -0.187 | -4 | 11.39 | 2.51368 | -0.04747 | 11.92 | -3.84544 | 4 |
| 10.87 | -0.18996 | -4 | 11.4 | 2.50747 | -3.15174 | 11.93 | -3.53644 | 4 |
| 10.88 | -0.18838 | -3.13159 | 11.41 | 2.50681 | -3.46359 | 11.94 | -3.18258 | 4 |
| 10.89 | -0.18166 | 0.22763 | 11.42 | 2.50549 | -3.92032 | 11.95 | -2.78099 | 4 |
| 10.9 | -0.17389 | 3.88049 | 11.43 | 2.50341 | -3.99937 | 11.96 | -2.33646 | 4 |
| 10.91 | -0.16212 | 4 | 11.44 | 2.49823 | -4 | 11.97 | -1.85658 | 4 |
| 10.92 | -0.15643 | 4 | 11.45 | 2.49522 | -4 | 11.98 | -1.34887 | 4 |
| 10.93 | -0.15464 | 3.99866 | 11.46 | 2.49129 | -4 | 11.99 | -0.81701 | 4 |
| 10.94 | -0.14968 | 4 | 11.47 | 2.48571 | -4 | 12 | -0.26521 | 4 |
| 10.95 | -0.14169 | 4 | 11.48 | 2.4765 | -4 | 12.01 | 0.30627 | 4 |
| 10.96 | -0.13257 | 4 | 11.49 | 2.46457 | -4 | 12.02 | 0.87879 | 4 |
| 10.97 | -0.11939 | 4 | 11.5 | 2.44984 | -4 | 12.03 | 1.45355 | 4 |
| 10.98 | -0.11474 | 4 | 11.51 | 2.43208 | -4 | 12.04 | 2.02139 | 4 |
| 10.99 | -0.1086 | 4 | 11.52 | 2.41182 | -4 | 12.05 | 2.58574 | 4 |
| 11 | -0.09916 | 4 | 11.53 | 2.38386 | -4 | 12.06 | 3.14056 | 4 |
| 11.01 | -0.07759 | 4 | 11.54 | 2.34137 | -4 | 12.07 | 3.67637 | 4 |
| 11.02 | -0.05492 | 4 | 11.55 | 2.28433 | -4 | 12.08 | 4.1823 | 4 |
| 11.03 | -0.02736 | 4 | 11.56 | 2.21372 | -4 | 12.09 | 4.65872 | 4 |
| 11.04 | -7.87E-05 | 4 | 11.57 | 2.13196 | -4 | 12.1 | 5.10706 | 4 |
| 11.05 | 0.03262 | 4 | 11.58 | 2.03368 | -4 | 12.11 | 5.52705 | 4 |
| 11.06 | 0.0722 | 4 | 11.59 | 1.92011 | -4 | 12.12 | 5.91099 | 4 |
| 11.07 | 0.1247 | 4 | 11.6 | 1.78691 | -4 | 12.13 | 6.25384 | 4 |
| 11.08 | 0.18261 | 4 | 11.61 | 1.63206 | -4 | 12.14 | 6.54654 | 4 |
| 11.09 | 0.24883 | 4 | 11.62 | 1.45265 | -4 | 12.15 | 6.79078 | 4 |
| 11.1 | 0.32146 | 4 | 11.63 | 1.2528 | -4 | 12.16 | 6.98888 | 4 |
| 11.11 | 0.40371 | 4 | 11.64 | 1.03133 | -4 | 12.17 | 7.14344 | 4 |
| 11.12 | 0.49839 | 4 | 11.65 | 0.79036 | -4 | 12.18 | 7.2506 | 4 |
| 11.13 | 0.59984 | 4 | 11.66 | 0.53047 | -4 | 12.19 | 7.30579 | 4 |
| 11.14 | 0.7065 | 4 | 11.67 | 0.25136 | -4 | 12.2 | 7.30574 | 0.70126 |
| 11.15 | 0.81569 | 4 | 11.68 | -0.0491 | -4 | 12.21 | 7.25663 | -4 |
| 11.16 | 0.92411 | 4 | 11.69 | -0.36877 | -4 | 12.22 | 7.16669 | -4 |
| 11.17 | 1.0365 | 4 | 11.7 | -0.69711 | -4 | 12.23 | 7.03418 | -4 |
| 11.18 | 1.15471 | 4 | 11.71 | -1.03802 | -4 | 12.24 | 6.86186 | -4 |
| 11.19 | 1.27736 | 4 | 11.72 | -1.37473 | -4 | 12.25 | 6.64229 | -4 |

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|---|---|---|---|---|---|---|---|---|
| 12.26 | 6.39374 | -4 | 12.79 | 4.20047 | 4 | 13.32 | -0.96229 | 4 |
| 12.27 | 6.1087 | -4 | 12.8 | 4.43031 | 4 | 13.33 | -0.88479 | 4 |
| 12.28 | 5.796 | -4 | 12.81 | 4.6249 | 4 | 13.34 | -0.79243 | 4 |
| 12.29 | 5.44784 | -4 | 12.82 | 4.78097 | 4 | 13.35 | -0.69069 | 4 |
| 12.3 | 5.06861 | -4 | 12.83 | 4.90498 | 4 | 13.36 | -0.58079 | 4 |
| 12.31 | 4.66375 | -4 | 12.84 | 4.99459 | 4 | 13.37 | -0.46264 | 4 |
| 12.32 | 4.24783 | -4 | 12.85 | 5.04542 | 4 | 13.38 | -0.33105 | 4 |
| 12.33 | 3.81469 | -4 | 12.86 | 5.05991 | 4 | 13.39 | -0.19058 | 4 |
| 12.34 | 3.36225 | -4 | 12.87 | 5.04845 | -1.73247 | 13.4 | -0.04883 | 4 |
| 12.35 | 2.88869 | -4 | 12.88 | 5.01171 | -4 | 13.41 | 0.08873 | 4 |
| 12.36 | 2.40597 | -4 | 12.89 | 4.95122 | -4 | 13.42 | 0.22346 | 4 |
| 12.37 | 1.91922 | -4 | 12.9 | 4.8598 | -4 | 13.43 | 0.35553 | 4 |
| 12.38 | 1.43807 | -4 | 12.91 | 4.74754 | -4 | 13.44 | 0.48614 | 4 |
| 12.39 | 0.95667 | -4 | 12.92 | 4.61801 | -4 | 13.45 | 0.61309 | 4 |
| 12.4 | 0.47493 | -4 | 12.93 | 4.48656 | -4 | 13.46 | 0.73311 | 4 |
| 12.41 | -0.002 | -4 | 12.94 | 4.34492 | -4 | 13.47 | 0.84019 | 4 |
| 12.42 | -0.46455 | -4 | 12.95 | 4.19148 | -4 | 13.48 | 0.93568 | 4 |
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| 12.47 | -2.43032 | -4 | 13 | 3.32368 | -4 | 13.53 | 1.27858 | 4 |
| 12.48 | -2.73823 | -4 | 13.01 | 3.14241 | -4 | 13.54 | 1.31512 | 4 |
| 12.49 | -3.00661 | -4 | 13.02 | 2.95761 | -4 | 13.55 | 1.3411 | 4 |
| 12.5 | -3.23321 | -4 | 13.03 | 2.77557 | -4 | 13.56 | 1.35914 | 4 |
| 12.51 | -3.41777 | -4 | 13.04 | 2.59674 | -4 | 13.57 | 1.37042 | 4 |
| 12.52 | -3.56283 | -4 | 13.05 | 2.41391 | -4 | 13.58 | 1.3782 | 4 |
| 12.53 | -3.66359 | -4 | 13.06 | 2.22648 | -4 | 13.59 | 1.38421 | 4 |
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| 12.67 | -0.45823 | 4 | 13.2 | -0.34144 | -4 | 13.73 | 1.45499 | 4 |
| 12.68 | -0.00706 | 4 | 13.21 | -0.48833 | -4 | 13.74 | 1.457 | 3.99742 |
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| 12.7 | 0.90015 | 4 | 13.23 | -0.74229 | -4 | 13.76 | 1.44511 | -1.94667 |
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| 12.72 | 1.78168 | 4 | 13.25 | -0.9405 | -4 | 13.78 | 1.41656 | -4 |
| 12.73 | 2.19992 | 4 | 13.26 | -1.00532 | -4 | 13.79 | 1.39057 | -4 |
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| 12.76 | 3.32001 | 4 | 13.29 | -1.06793 | -2.30961 | 13.82 | 1.24261 | -4 |
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|---|---|---|---|---|---|---|---|---|
| 13.85 | 0.96066 | -4 | 14.38 | -1.96023 | 4 | 14.91 | -5.76319 | 3.99994 |
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| 13.87 | 0.68458 | -4 | 14.4 | -1.54081 | 4 | 14.93 | -5.7007 | 4 |
| 13.88 | 0.52522 | -4 | 14.41 | -1.33695 | 4 | 14.94 | -5.65076 | 4 |
| 13.89 | 0.34564 | -4 | 14.42 | -1.13505 | 4 | 14.95 | -5.5946 | 4 |
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| 13.91 | -0.06832 | -4 | 14.44 | -0.74596 | 4 | 14.97 | -5.47411 | 4 |
| 13.92 | -0.29196 | -4 | 14.45 | -0.56964 | 4 | 14.98 | -5.40468 | 4 |
| 13.93 | -0.52416 | -4 | 14.46 | -0.40981 | 4 | 14.99 | -5.32611 | 4 |
| 13.94 | -0.76325 | -4 | 14.47 | -0.26466 | 4 | 15 | -5.24049 | 4 |
| 13.95 | -1.01326 | -4 | 14.48 | -0.13422 | 4 | 15.01 | -5.15262 | 4 |
| 13.96 | -1.27104 | -4 | 14.49 | -0.02259 | 4 | 15.02 | -5.06566 | 4 |
| 13.97 | -1.5341 | -4 | 14.5 | 0.06458 | 4 | 15.03 | -4.97748 | 4 |
| 13.98 | -1.7938 | -4 | 14.51 | 0.12397 | 4 | 15.04 | -4.88348 | 4 |
| 13.99 | -2.04809 | -4 | 14.52 | 0.15696 | 4 | 15.05 | -4.78385 | 4 |
| 14 | -2.29737 | -4 | 14.53 | 0.16542 | 3.99096 | 15.06 | -4.68391 | 4 |
| 14.01 | -2.54511 | -4 | 14.54 | 0.15062 | -3.40525 | 15.07 | -4.58846 | 4 |
| 14.02 | -2.78729 | -4 | 14.55 | 0.11445 | -4 | 15.08 | -4.49719 | 4 |
| 14.03 | -3.01901 | -4 | 14.56 | 0.05053 | -4 | 15.09 | -4.40462 | 4 |
| 14.04 | -3.23682 | -4 | 14.57 | -0.04186 | -4 | 15.1 | -4.31007 | 4 |
| 14.05 | -3.44174 | -4 | 14.58 | -0.16208 | -4 | 15.11 | -4.21791 | 4 |
| 14.06 | -3.6343 | -4 | 14.59 | -0.30092 | -4 | 15.12 | -4.13368 | 4 |
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| 14.1 | -4.25274 | -4 | 14.63 | -1.04403 | -4 | 15.16 | -3.8685 | 4 |
| 14.11 | -4.36378 | -4 | 14.64 | -1.27872 | -4 | 15.17 | -3.82192 | 4 |
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| 14.14 | -4.58967 | -4 | 14.67 | -2.02682 | -4 | 15.2 | -3.76823 | 4 |
| 14.15 | -4.62405 | -4 | 14.68 | -2.29472 | -4 | 15.21 | -3.77232 | 1.89825 |
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| 14.18 | -4.62561 | 3.98498 | 14.71 | -3.10643 | -4 | 15.24 | -3.85164 | -4 |
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| 14.24 | -4.24679 | 4 | 14.77 | -4.55002 | -4 | 15.3 | -4.29836 | -4 |
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| 14.37 | -2.17151 | 4 | 14.9 | -5.77756 | -1.52438 | 15.43 | -6.04257 | -4 |

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|---|---|---|---|---|---|---|---|---|
| 15.44 | -6.1707 | -4 | 15.97 | -4.69919 | 4 | 16.5 | -4.86261 | -0.38078 |
| 15.45 | -6.29244 | -4 | 15.98 | -4.63209 | 4 | 16.51 | -4.85917 | 1.34027 |
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| 15.48 | -6.63149 | -4 | 16.01 | -4.47194 | 4 | 16.54 | -4.85023 | 3.37635 |
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| 15.56 | -7.10033 | -4 | 16.09 | -4.3289 | -0.63323 | 16.62 | -4.85632 | 0.3299 |
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| 15.58 | -7.11096 | -3.59037 | 16.11 | -4.34951 | -4 | 16.64 | -4.85193 | 2.52777 |
| 15.59 | -7.10307 | 0.35032 | 16.12 | -4.36323 | -4 | 16.65 | -4.85098 | 3.00131 |
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| 15.61 | -7.06971 | 4 | 16.14 | -4.40648 | -4 | 16.67 | -4.8498 | 3.56215 |
| 15.62 | -7.04254 | 4 | 16.15 | -4.42848 | -4 | 16.68 | -4.85133 | 2.79992 |
| 15.63 | -7.00511 | 4 | 16.16 | -4.44845 | -4 | 16.69 | -4.85501 | 0.95991 |
| 15.64 | -6.96666 | 4 | 16.17 | -4.46896 | -4 | 16.7 | -4.85829 | -0.68013 |
| 15.65 | -6.92974 | 4 | 16.18 | -4.49245 | -4 | 16.71 | -4.85945 | -1.25992 |
| 15.66 | -6.89528 | 4 | 16.19 | -4.51999 | -4 | 16.72 | -4.85889 | -0.98079 |
| 15.67 | -6.85466 | 4 | 16.2 | -4.54966 | -4 | 16.73 | -4.85784 | -0.45477 |
| 15.68 | -6.8087 | 4 | 16.21 | -4.57693 | -4 | 16.74 | -4.85702 | -0.04392 |
| 15.69 | -6.75563 | 4 | 16.22 | -4.60349 | -4 | 16.75 | -4.85578 | 0.57614 |
| 15.7 | -6.70285 | 4 | 16.23 | -4.63166 | -4 | 16.76 | -4.85331 | 1.81101 |
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| 15.72 | -6.59416 | 4 | 16.25 | -4.69405 | -4 | 16.78 | -4.84974 | 3.57381 |
| 15.73 | -6.53578 | 4 | 16.26 | -4.7227 | -4 | 16.79 | -4.85088 | 3.00469 |
| 15.74 | -6.47668 | 4 | 16.27 | -4.74785 | -4 | 16.8 | -4.85275 | 2.06984 |
| 15.75 | -6.41405 | 4 | 16.28 | -4.77324 | -4 | 16.81 | -4.85463 | 1.13228 |
| 15.76 | -6.35097 | 4 | 16.29 | -4.7993 | -4 | 16.82 | -4.85659 | 0.14878 |
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| 15.78 | -6.21233 | 4 | 16.31 | -4.8399 | -4 | 16.84 | -4.86066 | -1.88694 |
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| 15.81 | -5.98786 | 4 | 16.34 | -4.86207 | -4 | 16.87 | -4.8559 | 0.49708 |
| 15.82 | -5.91231 | 4 | 16.35 | -4.86829 | -4 | 16.88 | -4.85396 | 1.4634 |
| 15.83 | -5.83347 | 4 | 16.36 | -4.8693 | -3.63919 | 16.89 | -4.85287 | 2.00913 |
| 15.84 | -5.75117 | 4 | 16.37 | -4.8643 | -1.13922 | 16.9 | -4.85213 | 2.37824 |
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| 15.86 | -5.58316 | 4 | 16.39 | -4.85504 | 3.48288 | 16.92 | -4.85205 | 2.41972 |
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| 15.94 | -4.91594 | 4 | 16.47 | -4.86634 | -2.24755 | 17 | -4.85536 | 0.76698 |
| 15.95 | -4.84294 | 4 | 16.48 | -4.86408 | -1.11746 | 17.01 | -4.85264 | 2.12467 |
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|---|---|---|---|---|---|---|---|---|
| 17.03 | -4.85097 | 2.95965 | 17.56 | -4.85662 | 0.12833 | 18.09 | -4.85789 | -0.50683 |
| 17.04 | -4.85206 | 2.41396 | 17.57 | -4.85831 | -0.71431 | 18.1 | -4.85637 | 0.2524 |
| 17.05 | -4.85343 | 1.72735 | 17.58 | -4.8591 | -1.11204 | 18.11 | -4.85461 | 1.13462 |
| 17.06 | -4.85504 | 0.9263 | 17.59 | -4.85872 | -0.92107 | 18.12 | -4.85301 | 1.93327 |
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| 17.11 | -4.85665 | 0.11669 | 17.64 | -4.85071 | 3.08273 | 18.17 | -4.85618 | 0.34926 |
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| 17.13 | -4.85254 | 2.1748 | 17.66 | -4.85194 | 2.46916 | 18.19 | -4.85938 | -1.2501 |
| 17.14 | -4.85122 | 2.83492 | 17.67 | -4.85401 | 1.43172 | 18.2 | -4.85993 | -1.52727 |
| 17.15 | -4.85038 | 3.25062 | 17.68 | -4.85621 | 0.33201 | 18.21 | -4.85953 | -1.32542 |
| 17.16 | -4.85044 | 3.22144 | 17.69 | -4.85797 | -0.54816 | 18.22 | -4.85826 | -0.69292 |
| 17.17 | -4.85182 | 2.53038 | 17.7 | -4.85901 | -1.06866 | 18.23 | -4.85652 | 0.1779 |
| 17.18 | -4.85418 | 1.3529 | 17.71 | -4.85923 | -1.17708 | 18.24 | -4.85484 | 1.01645 |
| 17.19 | -4.85649 | 0.19666 | 17.72 | -4.85857 | -0.84443 | 18.25 | -4.8537 | 1.58841 |
| 17.2 | -4.85807 | -0.59345 | 17.73 | -4.85707 | -0.09898 | 18.26 | -4.85335 | 1.76175 |
| 17.21 | -4.85885 | -0.98238 | 17.74 | -4.85514 | 0.87036 | 18.27 | -4.85386 | 1.50676 |
| 17.22 | -4.85887 | -0.99519 | 17.75 | -4.85337 | 1.75144 | 18.28 | -4.85512 | 0.88036 |
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| 18.62 | -4.85328 | 1.7967 | 19.15 | -4.85694 | -0.03378 | 19.68 | -4.86088 | -2.00127 |
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| 20.21 | -4.85699 | -0.05668 | 20.74 | -4.85618 | 0.34623 | 21.27 | -4.85983 | -1.47416 |
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| 21.8 | -4.85847 | -0.79454 | 22.33 | -4.85638 | 0.24603 | 22.86 | -4.85858 | -0.85043 |
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| 22 | -4.8594 | -1.26328 | 22.53 | -4.85881 | -0.96766 | 23.06 | -4.85571 | 0.58448 |
| 22.01 | -4.85998 | -1.55297 | 22.54 | -4.858 | -0.55973 | 23.07 | -4.85561 | 0.63558 |
| 22.02 | -4.86015 | -1.63525 | 22.55 | -4.85711 | -0.11905 | 23.08 | -4.85588 | 0.49677 |
| 22.03 | -4.85985 | -1.48461 | 22.56 | -4.85638 | 0.24826 | 23.09 | -4.85646 | 0.20637 |
| 22.04 | -4.85914 | -1.1341 | 22.57 | -4.85597 | 0.45542 | 23.1 | -4.8572 | -0.15924 |
| 22.05 | -4.85821 | -0.66752 | 22.58 | -4.85596 | 0.45714 | 23.11 | -4.85789 | -0.50551 |
| 22.06 | -4.85727 | -0.19714 | 22.59 | -4.85636 | 0.25898 | 23.12 | -4.85836 | -0.74361 |
| 22.07 | -4.85655 | 0.16347 | 22.6 | -4.85704 | -0.08392 | 23.13 | -4.8585 | -0.8141 |
| 22.08 | -4.85622 | 0.32929 | 22.61 | -4.85784 | -0.47991 | 23.14 | -4.85828 | -0.70138 |
| 22.09 | -4.85634 | 0.26613 | 22.62 | -4.85853 | -0.82421 | 23.15 | -4.85775 | -0.43628 |
| 22.1 | -4.85688 | -0.00281 | 22.63 | -4.85893 | -1.02606 | 23.16 | -4.85705 | -0.08873 |
| 22.11 | -4.85768 | -0.40301 | 22.64 | -4.85894 | -1.03311 | 23.17 | -4.85638 | 0.24945 |
| 22.12 | -4.85853 | -0.82654 | 22.65 | -4.85856 | -0.84338 | 23.18 | -4.8559 | 0.48864 |
| 22.13 | -4.8592 | -1.16033 | 22.66 | -4.85789 | -0.50495 | 23.19 | -4.85575 | 0.56458 |
| 22.14 | -4.85951 | -1.31539 | 22.67 | -4.85709 | -0.10413 | 23.2 | -4.85597 | 0.4542 |
| 22.15 | -4.85937 | -1.24859 | 22.68 | -4.85637 | 0.25586 | 23.21 | -4.85651 | 0.18186 |
| 22.16 | -4.85883 | -0.97491 | 22.69 | -4.85591 | 0.48206 | 23.22 | -4.85725 | -0.18725 |
| 22.17 | -4.858 | -0.56229 | 22.7 | -4.85585 | 0.51526 | 23.23 | -4.858 | -0.56409 |
| 22.18 | -4.8571 | -0.1137 | 22.71 | -4.85619 | 0.34438 | 23.24 | -4.85859 | -0.8575 |
| 22.19 | -4.85636 | 0.25824 | 22.72 | -4.85686 | 0.01063 | 23.25 | -4.85887 | -0.99751 |
| 22.2 | -4.85596 | 0.4599 | 22.73 | -4.85769 | -0.40425 | 23.26 | -4.85878 | -0.95331 |
| 22.21 | -4.856 | 0.44054 | 22.74 | -4.85848 | -0.79951 | 23.27 | -4.85836 | -0.74065 |
| 22.22 | -4.85647 | 0.20402 | 22.75 | -4.85904 | -1.0794 | 23.28 | -4.85771 | -0.41666 |
| 22.23 | -4.85726 | -0.19074 | 22.76 | -4.85923 | -1.17782 | 23.29 | -4.85701 | -0.06773 |
| 22.24 | -4.85817 | -0.64469 | 22.77 | -4.85903 | -1.07525 | 23.3 | -4.85645 | 0.21505 |
| 22.25 | -4.85897 | -1.04505 | 22.78 | -4.85848 | -0.8033 | 23.31 | -4.85616 | 0.35961 |
| 22.26 | -4.85946 | -1.29401 | 22.79 | -4.85775 | -0.43644 | 23.32 | -4.85622 | 0.33016 |
| 22.27 | -4.85954 | -1.33395 | 22.8 | -4.85702 | -0.07261 | 23.33 | -4.85661 | 0.13426 |
| 22.28 | -4.8592 | -1.15958 | 22.81 | -4.85649 | 0.19213 | 23.34 | -4.85723 | -0.17767 |
| 22.29 | -4.85852 | -0.81974 | 22.82 | -4.8563 | 0.28769 | 23.35 | -4.85792 | -0.52365 |
| 22.3 | -4.85769 | -0.40638 | 22.83 | -4.8565 | 0.18679 | 23.36 | -4.8585 | -0.8126 |
| 22.31 | -4.85694 | -0.02995 | 22.84 | -4.85705 | -0.08685 | 23.37 | -4.85881 | -0.96778 |
| 22.32 | -4.85646 | 0.20865 | 22.85 | -4.85781 | -0.46437 | 23.38 | -4.85877 | -0.94661 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 23.39 | -4.85838 | -0.75104 | 23.92 | -4.8554 | 0.73876 | 24.45 | -4.85561 | 0.63385 |
| 23.4 | -4.85773 | -0.4258 | 23.93 | -4.8552 | 0.83655 | 24.46 | -4.85617 | 0.35243 |
| 23.41 | -4.85697 | -0.04784 | 23.94 | -4.85533 | 0.77175 | 24.47 | -4.85664 | 0.11853 |
| 23.42 | -4.85629 | 0.29297 | 23.95 | -4.85574 | 0.56737 | 24.48 | -4.85689 | -0.00778 |
| 23.43 | -4.85584 | 0.51647 | 23.96 | -4.85631 | 0.28145 | 24.49 | -4.85687 | 0.00495 |
| 23.44 | -4.85573 | 0.5734 | 23.97 | -4.85689 | -0.00824 | 24.5 | -4.85657 | 0.1523 |
| 23.45 | -4.85597 | 0.4557 | 23.98 | -4.85732 | -0.22409 | 24.51 | -4.85609 | 0.39527 |
| 23.46 | -4.85647 | 0.20121 | 23.99 | -4.85749 | -0.3083 | 24.52 | -4.85554 | 0.67022 |
| 23.47 | -4.85711 | -0.11772 | 24 | -4.85735 | -0.23679 | 24.53 | -4.85507 | 0.90472 |
| 23.48 | -4.8577 | -0.41358 | 24.01 | -4.85693 | -0.0258 | 24.54 | -4.8548 | 1.03634 |
| 23.49 | -4.85809 | -0.6052 | 24.02 | -4.85633 | 0.27158 | 24.55 | -4.85482 | 1.02913 |
| 23.5 | -4.85816 | -0.63912 | 24.03 | -4.85572 | 0.57989 | 24.56 | -4.85511 | 0.88206 |
| 23.51 | -4.85788 | -0.50201 | 24.04 | -4.85524 | 0.82056 | 24.57 | -4.85562 | 0.62939 |
| 23.52 | -4.85733 | -0.22417 | 24.05 | -4.85501 | 0.93226 | 24.58 | -4.85621 | 0.33188 |
| 23.53 | -4.85662 | 0.12711 | 24.06 | -4.8551 | 0.886 | 24.59 | -4.85675 | 0.0614 |
| 23.54 | -4.85595 | 0.46555 | 24.07 | -4.85549 | 0.69177 | 24.6 | -4.85711 | -0.11704 |
| 23.55 | -4.85546 | 0.70748 | 24.08 | -4.85608 | 0.39638 | 24.61 | -4.8572 | -0.16217 |
| 23.56 | -4.85529 | 0.79359 | 24.09 | -4.85673 | 0.07219 | 24.62 | -4.85701 | -0.06595 |
| 23.57 | -4.85547 | 0.70417 | 24.1 | -4.85728 | -0.20135 | 24.63 | -4.85659 | 0.14387 |
| 23.58 | -4.85595 | 0.46288 | 24.11 | -4.85759 | -0.3585 | 24.64 | -4.85606 | 0.41077 |
| 23.59 | -4.85662 | 0.13032 | 24.12 | -4.85761 | -0.36416 | 24.65 | -4.85555 | 0.66464 |
| 23.6 | -4.8573 | -0.20984 | 24.13 | -4.85732 | -0.2219 | 24.66 | -4.8552 | 0.83984 |
| 23.61 | -4.85782 | -0.47271 | 24.14 | -4.85682 | 0.02801 | 24.67 | -4.85509 | 0.89151 |
| 23.62 | -4.85807 | -0.59459 | 24.15 | -4.85624 | 0.31812 | 24.68 | -4.85526 | 0.80673 |
| 23.63 | -4.85797 | -0.54797 | 24.16 | -4.85574 | 0.57074 | 24.69 | -4.85566 | 0.60767 |
| 23.64 | -4.85757 | -0.3491 | 24.17 | -4.85544 | 0.71835 | 24.7 | -4.85618 | 0.34635 |
| 23.65 | -4.85698 | -0.05296 | 24.18 | -4.85543 | 0.72154 | 24.71 | -4.85669 | 0.09139 |
| 23.66 | -4.85635 | 0.26097 | 24.19 | -4.85572 | 0.57679 | 24.72 | -4.85706 | -0.08999 |
| 23.67 | -4.85586 | 0.50829 | 24.2 | -4.85624 | 0.31943 | 24.73 | -4.85718 | -0.14927 |
| 23.68 | -4.85563 | 0.62206 | 24.21 | -4.85685 | 0.01445 | 24.74 | -4.85701 | -0.06849 |
| 23.69 | -4.85574 | 0.56972 | 24.22 | -4.8574 | -0.261 | 24.75 | -4.85661 | 0.13545 |
| 23.7 | -4.85616 | 0.36087 | 24.23 | -4.85775 | -0.43722 | 24.76 | -4.85605 | 0.41507 |
| 23.71 | -4.85679 | 0.04528 | 24.24 | -4.85782 | -0.46937 | 24.77 | -4.85547 | 0.70392 |
| 23.72 | -4.85748 | -0.30013 | 24.25 | -4.85757 | -0.34832 | 24.78 | -4.85501 | 0.93365 |
| 23.73 | -4.85806 | -0.59064 | 24.26 | -4.85708 | -0.10301 | 24.79 | -4.85477 | 1.05148 |
| 23.74 | -4.85839 | -0.75514 | 24.27 | -4.85646 | 0.20679 | 24.8 | -4.85481 | 1.03383 |
| 23.75 | -4.85839 | -0.7549 | 24.28 | -4.85586 | 0.50591 | 24.81 | -4.85509 | 0.89123 |
| 23.76 | -4.85806 | -0.5916 | 24.29 | -4.85543 | 0.72231 | 24.82 | -4.85554 | 0.666 |
| 23.77 | -4.85749 | -0.30744 | 24.3 | -4.85527 | 0.80588 | 24.83 | -4.85603 | 0.42104 |
| 23.78 | -4.85683 | 0.02474 | 24.31 | -4.85539 | 0.74155 | 24.84 | -4.85643 | 0.2239 |
| 23.79 | -4.85623 | 0.32098 | 24.32 | -4.85577 | 0.55209 | 24.85 | -4.85662 | 0.12957 |
| 23.8 | -4.85586 | 0.50778 | 24.33 | -4.85629 | 0.29173 | 24.86 | -4.85654 | 0.16606 |
| 23.81 | -4.85579 | 0.54099 | 24.34 | -4.85681 | 0.03316 | 24.87 | -4.85622 | 0.32794 |
| 23.82 | -4.85604 | 0.41617 | 24.35 | -4.85718 | -0.1515 | 24.88 | -4.85572 | 0.5774 |
| 23.83 | -4.85654 | 0.16923 | 24.36 | -4.8573 | -0.20948 | 24.89 | -4.85517 | 0.8538 |
| 23.84 | -4.85714 | -0.13253 | 24.37 | -4.85712 | -0.11998 | 24.9 | -4.8547 | 1.08933 |
| 23.85 | -4.85769 | -0.4068 | 24.38 | -4.85668 | 0.09994 | 24.91 | -4.85442 | 1.22629 |
| 23.86 | -4.85803 | -0.57837 | 24.39 | -4.85608 | 0.39981 | 24.92 | -4.85441 | 1.23174 |
| 23.87 | -4.85807 | -0.59776 | 24.4 | -4.85546 | 0.70889 | 24.93 | -4.85467 | 1.10554 |
| 23.88 | -4.85779 | -0.45438 | 24.41 | -4.85497 | 0.95367 | 24.94 | -4.85512 | 0.88016 |
| 23.89 | -4.85723 | -0.17895 | 24.42 | -4.85472 | 1.07674 | 24.95 | -4.85565 | 0.61258 |
| 23.9 | -4.85655 | 0.16483 | 24.43 | -4.85477 | 1.05189 | 24.96 | -4.85614 | 0.36981 |
| 23.91 | -4.85588 | 0.49654 | 24.44 | -4.8551 | 0.88948 | 24.97 | -4.85645 | 0.21194 |

| | | |
|---|---|---|
| 24.98 | -4.85652 | 0.17611 |
| 24.99 | -4.85634 | 0.26856 |
| 25 | -4.85595 | 0.46269 |

# CAL-20776-SE-007

## NONLINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT M

## Trolley and Bridge Link/Support Parametric Analyses

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**Total Pages = 20**

NOTE: The parametric analyses conducted herein are for the Case-07, having the trolley at mid-span, and all use the A1 set of acceleration time histories.

## M.1 Summary of Parametric Analyses Member Force Results

| M.1 Parametric Analyses – Governing Member Response | | | | | | | |
|---|---|---|---|---|---|---|---|
| Link Support Element Attribute Variation | Crane Component | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
| Best Estimate Values (for all parameters) (BE) | Girders | 75 | 190 | 12 | 564 | 2,462 | 72,540 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,766 | 86 |
| | Trucks | 25 | 105 | 46 | 772 | 1,644 | 3,737 |
| Ke = Ke / 2 (KE-LB) | Girders | 74 | 190 | 12 | 562 | 2,463 | 72,545 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,766 | 87 |
| | Trucks | 25 | 105 | 46 | 771 | 1,644 | 3,734 |
| Ke = Ke x 2 (KE-UB) | Girders | 75 | 190 | 12 | 566 | 2,466 | 72,536 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,764 | 86 |
| | Trucks | 25 | 105 | 46 | 772 | 1,644 | 3,738 |
| K = K / 2 (K-LB) | Girders | 73 | 190 | 12 | 578 | 2,545 | 72,555 |
| | End-Ties | 11 | 2 | 15 | 0 | 1,735 | 82 |
| | Trucks | 23 | 105 | 46 | 770 | 1,648 | 3,735 |
| K = 2 x K (K-UB) | Girders | 77 | 191 | 12 | 553 | 2,510 | 72,492 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,765 | 84 |
| | Trucks | 24 | 105 | 45 | 763 | 1,618 | 3,757 |
| EXP = EXP / 2 (EXP-LB) | Girders | 75 | 190 | 12 | 564 | 2,460 | 72,539 |
| | End-Ties | 12 | 2 | 15 | 0 | 1,765 | 86 |
| | Trucks | 25 | 105 | 46 | 772 | 1,645 | 3,736 |

## M.2 Summary of Parametric Analyses Member Force Per-Cent Variation

| M.2 Parametric Analyses – Governing Member Response Variation wrt BE Response (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Link Support Element Attribute Variation | Crane Component | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
| Best Estimate Values (for all parameters) (BE) | Girders | 0 | 0 | 0 | 0 | 0 | 0 |
| | End-Ties | 0 | 0 | 0 | 0 | 0 | 0 |
| | Trucks | 0 | 0 | 0 | 0 | 0 | 0 |
| Ke = Ke / 2 (KE-LB) | Girders | -0.3 | 0.0 | -0.1 | -0.3 | 0.0 | 0.0 |
| | End-Ties | 0.5 | 0.3 | 0.0 | 0.0 | 0.0 | 0.4 |
| | Trucks | 0.4 | -0.1 | 0.0 | -0.1 | 0.0 | -0.1 |
| Ke = Ke x 2 (KE-UB) | Girders | 0.2 | 0.0 | 0.1 | 0.4 | 0.2 | 0.0 |
| | End-Ties | -0.7 | -0.3 | -0.1 | 0.0 | -0.1 | -0.3 |
| | Trucks | -0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| K = K / 2 (K-LB) | Girders | -2.1 | -0.1 | 3.1 | 2.5 | 3.4 | 0.0 |
| | End-Ties | -10.9 | -4.0 | -2.0 | 0.0 | -1.8 | -5.5 |
| | Trucks | -8.1 | 0.0 | 0.2 | -0.1 | 0.2 | 0.0 |
| K = 2 x K (K-UB) | Girders | 2.9 | 0.2 | 1.3 | -2.0 | 2.0 | -0.1 |
| | End-Ties | -6.4 | -1.7 | 0.4 | 0.0 | -0.1 | -3.1 |
| | Trucks | -4.1 | 0.5 | -1.6 | -1.2 | -1.6 | 0.5 |
| EXP = EXP / 2 (EXP-LB) | Girders | 0.0 | 0.0 | -0.1 | -0.1 | -0.1 | 0.0 |
| | End-Ties | -1.0 | 0.0 | 0.0 | 0.0 | -0.1 | 0.0 |
| | Trucks | -0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## M.3 Parametric Analysis – Best Estimate Values (BE)

### M.3.1 BE-Girders

| M.3.1 BE: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | BE | Max | 73 | -43 | 9 | 501 | 2,462 | 423 |
| G01 | 146 | BE | Max | 73 | -36 | 9 | 501 | 1,111 | 24,436 |
| G01 | 0 | BE | Min | -75 | -169 | -10 | -449 | -2,312 | -478 |
| G01 | 146 | BE | Min | -75 | -163 | -10 | -449 | -933 | 5,599 |
| G02 | 0 | BE | Max | 63 | -37 | 12 | 501 | 1,111 | 24,436 |
| G02 | 138 | BE | Max | 63 | -30 | 12 | 501 | 563 | 46,287 |
| G02 | 0 | BE | Min | -65 | -161 | -10 | -449 | -933 | 5,599 |
| G02 | 138 | BE | Min | -65 | -155 | -10 | -449 | -526 | 10,286 |
| G03 | 0 | BE | Max | 53 | -32 | 11 | 501 | 563 | 46,287 |
| G03 | 174.5 | BE | Max | 53 | -24 | 11 | 501 | 2,133 | 72,306 |
| G03 | 0 | BE | Min | -58 | -153 | -10 | -449 | -526 | 10,286 |
| G03 | 174.5 | BE | Min | -58 | -145 | -10 | -449 | -2,462 | 15,235 |
| G04 | 0 | BE | Max | 48 | 15 | 1 | 127 | 2,133 | 72,540 |
| G04 | 36.5 | BE | Max | 48 | 16 | 1 | 127 | 2,104 | 72,030 |
| G04 | 0 | BE | Min | -44 | 3 | -1 | -155 | -2,462 | 14,915 |
| G04 | 36.5 | BE | Min | -44 | 4 | -1 | -155 | -2,421 | 14,784 |
| G05 | 0 | BE | Max | 43 | 17 | 2 | 127 | 2,104 | 72,030 |
| G05 | 138 | BE | Max | 43 | 22 | 2 | 127 | 1,908 | 70,011 |
| G05 | 0 | BE | Min | -40 | 3 | -2 | -155 | -2,421 | 14,784 |
| G05 | 138 | BE | Min | -40 | 8 | -2 | -155 | -2,174 | 14,153 |
| G06 | 0 | BE | Max | 37 | 170 | 10 | 497 | 1,908 | 70,011 |
| G06 | 73 | BE | Max | 37 | 175 | 10 | 497 | 1,068 | 52,526 |
| G06 | 0 | BE | Min | -34 | 29 | -11 | -564 | -2,174 | 14,153 |
| G06 | 73 | BE | Min | -34 | 34 | -11 | -564 | -1,124 | 10,984 |
| G07 | 0 | BE | Max | 30 | 176 | 10 | 497 | 1,068 | 52,526 |
| G07 | 146 | BE | Max | 30 | 182 | 10 | 497 | 577 | 27,791 |
| G07 | 0 | BE | Min | -28 | 32 | -11 | -564 | -1,124 | 10,984 |
| G07 | 146 | BE | Min | -28 | 38 | -11 | -564 | -465 | 6,125 |
| G08 | 0 | BE | Max | 22 | 184 | 9 | 497 | 577 | 27,791 |
| G08 | 138 | BE | Max | 22 | 190 | 9 | 497 | 1,761 | 720 |
| G08 | 0 | BE | Min | -20 | 37 | -9 | -564 | -465 | 6,125 |
| G08 | 138 | BE | Min | -20 | 44 | -9 | -564 | -1,611 | -706 |
| G09 | 0 | BE | Max | 63 | -41 | 9 | 494 | 2,460 | 493 |
| G09 | 146 | BE | Max | 63 | -35 | 9 | 494 | 1,075 | 23,790 |
| G09 | 0 | BE | Min | -61 | -168 | -10 | -448 | -2,304 | -488 |
| G09 | 146 | BE | Min | -61 | -162 | -10 | -448 | -920 | 5,456 |
| G10 | 0 | BE | Max | 54 | -36 | 11 | 494 | 1,075 | 23,790 |
| G10 | 138 | BE | Max | 54 | -30 | 11 | 494 | 528 | 45,576 |
| G10 | 0 | BE | Min | -52 | -161 | -10 | -448 | -920 | 5,456 |
| G10 | 138 | BE | Min | -52 | -155 | -10 | -448 | -530 | 10,033 |
| G11 | 0 | BE | Max | 45 | -32 | 11 | 494 | 528 | 45,576 |
| G11 | 174.5 | BE | Max | 45 | -25 | 11 | 494 | 2,133 | 71,721 |
| G11 | 0 | BE | Min | -46 | -153 | -10 | -448 | -530 | 10,033 |
| G11 | 174.5 | BE | Min | -46 | -146 | -10 | -448 | -2,433 | 14,986 |
| G12 | 0 | BE | Max | 34 | 15 | 2 | 135 | 2,133 | 71,930 |
| G12 | 36.5 | BE | Max | 34 | 17 | 2 | 135 | 2,096 | 71,375 |

| M.3.1 BE: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G12 | 0 | BE | Min | -38 | 3 | -2 | -148 | -2,433 | 14,835 |
| G12 | 36.5 | BE | Min | -38 | 5 | -2 | -148 | -2,395 | 14,673 |
| G13 | 0 | BE | Max | 30 | 17 | 2 | 135 | 2,096 | 71,375 |
| G13 | 138 | BE | Max | 30 | 22 | 2 | 135 | 1,908 | 69,271 |
| G13 | 0 | BE | Min | -34 | 3 | -3 | -148 | -2,395 | 14,673 |
| G13 | 138 | BE | Min | -34 | 8 | -3 | -148 | -2,166 | 13,982 |
| G14 | 0 | BE | Max | 25 | 172 | 10 | 494 | 1,908 | 69,271 |
| G14 | 73 | BE | Max | 25 | 176 | 10 | 494 | 1,058 | 51,650 |
| G14 | 0 | BE | Min | -29 | 30 | -11 | -546 | -2,166 | 13,982 |
| G14 | 73 | BE | Min | -29 | 34 | -11 | -546 | -1,115 | 10,722 |
| G15 | 0 | BE | Max | 21 | 177 | 10 | 494 | 1,058 | 51,650 |
| G15 | 146 | BE | Max | 21 | 183 | 10 | 494 | 546 | 26,826 |
| G15 | 0 | BE | Min | -22 | 33 | -11 | -546 | -1,115 | 10,722 |
| G15 | 146 | BE | Min | -22 | 38 | -11 | -546 | -440 | 5,826 |
| G16 | 0 | BE | Max | 17 | 184 | 9 | 494 | 546 | 26,826 |
| G16 | 138 | BE | Max | 17 | 190 | 9 | 494 | 1,749 | 730 |
| G16 | 0 | BE | Min | -18 | 37 | -9 | -546 | -440 | 5,826 |
| G16 | 138 | BE | Min | -18 | 43 | -9 | -546 | -1,572 | -619 |
| | | **Girder** | **Max:** | **73** | **190** | **12** | **501** | **2,462** | **72,540** |
| | | **BE** | **Min:** | **-75** | **-169** | **-11** | **-564** | **-2,462** | **-706** |
| | | | **Abs:** | **75** | **190** | **12** | **564** | **2,462** | **72,540** |

## M.3.2 BE-End Ties

| M.3.2 BE: Element Forces - Frames - End Ties | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| End Tie | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | BE | Max | 8 | -1 | 8 | 0 | 991 | -26 |
| ET1 | 120 | BE | Max | 8 | 0 | 8 | 0 | 67 | 55 |
| ET1 | 0 | BE | Min | -8 | -2 | -9 | 0 | -1,066 | -80 |
| ET1 | 120 | BE | Min | -8 | 0 | -9 | 0 | -68 | -1 |
| ET2 | 0 | BE | Max | 7 | 0 | 9 | 0 | 67 | 55 |
| ET2 | 120 | BE | Max | 7 | 2 | 9 | 0 | 1,041 | -23 |
| ET2 | 0 | BE | Min | -7 | 0 | -9 | 0 | -68 | -1 |
| ET2 | 120 | BE | Min | -7 | 1 | -9 | 0 | -1,016 | -83 |
| ET3 | 0 | BE | Max | 10 | -1 | 15 | 0 | 1,766 | -24 |
| ET3 | 120 | BE | Max | 10 | 0 | 15 | 0 | 129 | 57 |
| ET3 | 0 | BE | Min | -12 | -2 | -14 | 0 | -1,612 | -83 |
| ET3 | 120 | BE | Min | -12 | -1 | -14 | 0 | -106 | -3 |
| ET4 | 0 | BE | Max | 9 | 1 | 15 | 0 | 129 | 57 |
| ET4 | 120 | BE | Max | 9 | 2 | 15 | 0 | 1,575 | -21 |
| ET4 | 0 | BE | Min | -11 | -1 | -13 | 0 | -106 | -3 |
| ET4 | 120 | BE | Min | -11 | 1 | -13 | 0 | -1,754 | -86 |
| | | **End Tie** | **Max:** | **10** | **2** | **15** | **0** | **1,766** | **57** |
| | | **BE** | **Min:** | **-12** | **-2** | **-14** | **0** | **-1,754** | **-86** |
| | | | **Abs:** | **12** | **2** | **15** | **0** | **1,766** | **86** |

## M.3.3 BE-Trucks

| M.3.3 BE: Element Forces - Frames - Trucks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | BE | Max | 14 | -19 | 40 | 735 | 0 | 250 |
| TK1 | 36 | BE | Max | 14 | -17 | 40 | 735 | 1,525 | 3,050 |
| TK1 | 0 | BE | Min | -16 | -90 | -42 | -677 | 0 | -273 |
| TK1 | 36 | BE | Min | -16 | -88 | -42 | -677 | -1,425 | 693 |
| TK2 | 0 | BE | Max | 1 | 93 | 45 | 772 | 1,608 | 3,368 |
| TK2 | 36 | BE | Max | 1 | 95 | 45 | 772 | 0 | 0 |
| TK2 | 0 | BE | Min | -1 | 19 | -46 | -758 | -1,644 | 724 |
| TK2 | 36 | BE | Min | -1 | 21 | -46 | -758 | 0 | 0 |
| TK3 | 0 | BE | Max | 1 | -20 | 36 | 615 | 0 | 0 |
| TK3 | 36 | BE | Max | 1 | -18 | 36 | 615 | 1,265 | 3,088 |
| TK3 | 0 | BE | Min | -1 | -87 | -35 | -618 | 0 | 0 |
| TK3 | 36 | BE | Min | -1 | -85 | -35 | -618 | -1,297 | 667 |
| TK4 | 0 | BE | Max | 1 | 86 | 38 | 673 | 1,385 | 3,115 |
| TK4 | 36 | BE | Max | 1 | 88 | 38 | 673 | 0 | 0 |
| TK4 | 0 | BE | Min | -1 | 22 | -39 | -677 | -1,399 | 823 |
| TK4 | 36 | BE | Min | -1 | 24 | -39 | -677 | 0 | 0 |
| TK5 | 0 | BE | Max | 21 | -22 | 2 | 0 | 0 | 361 |
| TK5 | 36 | BE | Max | 21 | -20 | 2 | 0 | 49 | 3,443 |
| TK5 | 0 | BE | Min | -25 | -99 | -1 | -1 | 0 | -429 |
| TK5 | 36 | BE | Min | -25 | -97 | -1 | -1 | -62 | 726 |
| TK6 | 0 | BE | Max | 1 | 103 | 1 | 0 | 51 | 3,737 |
| TK6 | 36 | BE | Max | 1 | 105 | 1 | 0 | 0 | 0 |
| TK6 | 0 | BE | Min | -1 | 20 | -2 | 0 | -62 | 773 |
| TK6 | 36 | BE | Min | -1 | 22 | -2 | 0 | 0 | 0 |
| TK7 | 0 | BE | Max | 1 | -21 | 2 | 0 | 0 | 0 |
| TK7 | 36 | BE | Max | 1 | -19 | 2 | 0 | 52 | 3,469 |
| TK7 | 0 | BE | Min | -1 | -97 | -1 | 0 | 0 | 0 |
| TK7 | 36 | BE | Min | -1 | -95 | -1 | 0 | -63 | 719 |
| TK8 | 0 | BE | Max | 1 | 97 | 1 | 0 | 51 | 3,538 |
| TK8 | 36 | BE | Max | 1 | 99 | 1 | 0 | 0 | 0 |
| TK8 | 0 | BE | Min | -1 | 22 | -1 | 0 | -54 | 836 |
| TK8 | 36 | BE | Min | -1 | 24 | -1 | 0 | 0 | 0 |
| | | **Trucks** | **Max:** | **21** | **105** | **45** | **772** | **1,608** | **3,737** |
| | | **BE** | **Min:** | **-25** | **-99** | **-46** | **-758** | **-1,644** | **-429** |
| | | | **Abs:** | **25** | **105** | **46** | **772** | **1,644** | **3,737** |

## M.4 Parametric Analysis – Ke = Ke / 2 (KE-LB)

### M.4.1 KE-LB -Girders

| M.4.1 Ke-LB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | KE-LB | Max | 73 | -43 | 9 | 500 | 2,458 | 422 |
| G01 | 146 | KE-LB | Max | 73 | -36 | 9 | 500 | 1,112 | 24,437 |
| G01 | 0 | KE-LB | Min | -74 | -169 | -10 | -448 | -2,302 | -478 |
| G01 | 146 | KE-LB | Min | -74 | -163 | -10 | -448 | -928 | 5,597 |
| G02 | 0 | KE-LB | Max | 63 | -37 | 12 | 500 | 1,112 | 24,437 |
| G02 | 138 | KE-LB | Max | 63 | -30 | 12 | 500 | 561 | 46,291 |
| G02 | 0 | KE-LB | Min | -65 | -161 | -10 | -448 | -928 | 5,597 |
| G02 | 138 | KE-LB | Min | -65 | -155 | -10 | -448 | -527 | 10,277 |
| G03 | 0 | KE-LB | Max | 53 | -32 | 11 | 500 | 561 | 46,291 |
| G03 | 174.5 | KE-LB | Max | 53 | -24 | 11 | 500 | 2,124 | 72,310 |
| G03 | 0 | KE-LB | Min | -58 | -153 | -10 | -448 | -527 | 10,277 |
| G03 | 174.5 | KE-LB | Min | -58 | -145 | -10 | -448 | -2,463 | 15,228 |
| G04 | 0 | KE-LB | Max | 48 | 15 | 2 | 137 | 2,124 | 72,545 |
| G04 | 36.5 | KE-LB | Max | 48 | 16 | 2 | 137 | 2,095 | 72,035 |
| G04 | 0 | KE-LB | Min | -44 | 3 | -1 | -154 | -2,463 | 14,915 |
| G04 | 36.5 | KE-LB | Min | -44 | 4 | -1 | -154 | -2,423 | 14,785 |
| G05 | 0 | KE-LB | Max | 43 | 17 | 2 | 137 | 2,095 | 72,035 |
| G05 | 138 | KE-LB | Max | 43 | 22 | 2 | 137 | 1,901 | 70,011 |
| G05 | 0 | KE-LB | Min | -40 | 3 | -2 | -154 | -2,423 | 14,785 |
| G05 | 138 | KE-LB | Min | -40 | 8 | -2 | -154 | -2,175 | 14,159 |
| G06 | 0 | KE-LB | Max | 37 | 170 | 10 | 496 | 1,901 | 70,011 |
| G06 | 73 | KE-LB | Max | 37 | 175 | 10 | 496 | 1,067 | 52,522 |
| G06 | 0 | KE-LB | Min | -34 | 29 | -11 | -562 | -2,175 | 14,159 |
| G06 | 73 | KE-LB | Min | -34 | 34 | -11 | -562 | -1,122 | 10,992 |
| G07 | 0 | KE-LB | Max | 30 | 176 | 10 | 496 | 1,067 | 52,522 |
| G07 | 146 | KE-LB | Max | 30 | 182 | 10 | 496 | 580 | 27,785 |
| G07 | 0 | KE-LB | Min | -28 | 32 | -11 | -562 | -1,122 | 10,992 |
| G07 | 146 | KE-LB | Min | -28 | 38 | -11 | -562 | -465 | 6,129 |
| G08 | 0 | KE-LB | Max | 22 | 184 | 9 | 496 | 580 | 27,785 |
| G08 | 138 | KE-LB | Max | 22 | 190 | 9 | 496 | 1,761 | 717 |
| G08 | 0 | KE-LB | Min | -20 | 38 | -9 | -562 | -465 | 6,129 |
| G08 | 138 | KE-LB | Min | -20 | 44 | -9 | -562 | -1,606 | -706 |
| G09 | 0 | KE-LB | Max | 62 | -41 | 9 | 492 | 2,457 | 494 |
| G09 | 146 | KE-LB | Max | 62 | -35 | 9 | 492 | 1,077 | 23,789 |
| G09 | 0 | KE-LB | Min | -61 | -168 | -10 | -446 | -2,294 | -487 |
| G09 | 146 | KE-LB | Min | -61 | -162 | -10 | -446 | -918 | 5,456 |
| G10 | 0 | KE-LB | Max | 54 | -36 | 11 | 492 | 1,077 | 23,789 |
| G10 | 138 | KE-LB | Max | 54 | -30 | 11 | 492 | 531 | 45,578 |
| G10 | 0 | KE-LB | Min | -52 | -161 | -10 | -446 | -918 | 5,456 |
| G10 | 138 | KE-LB | Min | -52 | -155 | -10 | -446 | -530 | 10,029 |
| G11 | 0 | KE-LB | Max | 45 | -32 | 11 | 492 | 531 | 45,578 |
| G11 | 174.5 | KE-LB | Max | 45 | -25 | 11 | 492 | 2,127 | 71,723 |
| G11 | 0 | KE-LB | Min | -46 | -153 | -10 | -446 | -530 | 10,029 |
| G11 | 174.5 | KE-LB | Min | -46 | -146 | -10 | -446 | -2,434 | 14,979 |
| G12 | 0 | KE-LB | Max | 34 | 15 | 2 | 137 | 2,127 | 71,931 |

| M.4.1 Ke-LB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G12 | 36.5 | KE-LB | Max | 34 | 17 | 2 | 137 | 2,087 | 71,375 |
| G12 | 0 | KE-LB | Min | -37 | 3 | -2 | -149 | -2,434 | 14,834 |
| G12 | 36.5 | KE-LB | Min | -37 | 5 | -2 | -149 | -2,396 | 14,674 |
| G13 | 0 | KE-LB | Max | 30 | 17 | 2 | 137 | 2,087 | 71,375 |
| G13 | 138 | KE-LB | Max | 30 | 22 | 2 | 137 | 1,902 | 69,268 |
| G13 | 0 | KE-LB | Min | -34 | 4 | -3 | -149 | -2,396 | 14,674 |
| G13 | 138 | KE-LB | Min | -34 | 8 | -3 | -149 | -2,168 | 13,988 |
| G14 | 0 | KE-LB | Max | 24 | 172 | 10 | 491 | 1,902 | 69,268 |
| G14 | 73 | KE-LB | Max | 24 | 176 | 10 | 491 | 1,058 | 51,644 |
| G14 | 0 | KE-LB | Min | -28 | 30 | -11 | -544 | -2,168 | 13,988 |
| G14 | 73 | KE-LB | Min | -28 | 34 | -11 | -544 | -1,114 | 10,732 |
| G15 | 0 | KE-LB | Max | 21 | 177 | 10 | 491 | 1,058 | 51,644 |
| G15 | 146 | KE-LB | Max | 21 | 183 | 10 | 491 | 548 | 26,820 |
| G15 | 0 | KE-LB | Min | -22 | 33 | -11 | -544 | -1,114 | 10,732 |
| G15 | 146 | KE-LB | Min | -22 | 38 | -11 | -544 | -436 | 5,836 |
| G16 | 0 | KE-LB | Max | 17 | 184 | 9 | 491 | 548 | 26,820 |
| G16 | 138 | KE-LB | Max | 17 | 190 | 9 | 491 | 1,749 | 729 |
| G16 | 0 | KE-LB | Min | -18 | 37 | -9 | -544 | -436 | 5,836 |
| G16 | 138 | KE-LB | Min | -18 | 43 | -9 | -544 | -1,567 | -616 |
| | | **Girder** | **Max:** | **73** | **190** | **12** | **500** | **2,458** | **72,545** |
| | | **KE-LB** | **Min:** | **-74** | **-169** | **-11** | **-562** | **-2,463** | **-706** |
| | | | **Abs:** | **74** | **190** | **12** | **562** | **2,463** | **72,545** |

## M.4.2 KE-LB -End Ties

| M.4.2 Ke-LB: Element Forces - Frames - End Ties | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| End Tie | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | KE-LB | Max | 8 | -1 | 8 | 0 | 986 | -26 |
| ET1 | 120 | KE-LB | Max | 8 | 0 | 8 | 0 | 67 | 55 |
| ET1 | 0 | KE-LB | Min | -8 | -2 | -9 | 0 | -1,068 | -80 |
| ET1 | 120 | KE-LB | Min | -8 | 0 | -9 | 0 | -69 | -1 |
| ET2 | 0 | KE-LB | Max | 7 | 1 | 9 | 0 | 67 | 55 |
| ET2 | 120 | KE-LB | Max | 7 | 2 | 9 | 0 | 1,038 | -23 |
| ET2 | 0 | KE-LB | Min | -7 | 0 | -9 | 0 | -69 | -1 |
| ET2 | 120 | KE-LB | Min | -7 | 1 | -9 | 0 | -1,011 | -84 |
| ET3 | 0 | KE-LB | Max | 10 | -1 | 15 | 0 | 1,766 | -24 |
| ET3 | 120 | KE-LB | Max | 10 | 0 | 15 | 0 | 127 | 58 |
| ET3 | 0 | KE-LB | Min | -12 | -2 | -14 | 0 | -1,606 | -83 |
| ET3 | 120 | KE-LB | Min | -12 | -1 | -14 | 0 | -105 | -3 |
| ET4 | 0 | KE-LB | Max | 9 | 1 | 15 | 0 | 127 | 58 |
| ET4 | 120 | KE-LB | Max | 9 | 2 | 15 | 0 | 1,570 | -21 |
| ET4 | 0 | KE-LB | Min | -11 | -1 | -13 | 0 | -105 | -3 |
| ET4 | 120 | KE-LB | Min | -11 | 1 | -13 | 0 | -1,754 | -87 |
| | | **End Tie** | **Max:** | **10** | **2** | **15** | **0** | **1,766** | **58** |
| | | **KE-LB** | **Min:** | **-12** | **-2** | **-14** | **0** | **-1,754** | **-87** |
| | | | **Abs:** | **12** | **2** | **15** | **0** | **1,766** | **87** |

## M.4.3 KE-LB -Trucks

| M.4.3 Ke-LB: Element Forces - Frames - Trucks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | KE-LB | Max | 15 | -19 | 40 | 737 | 0 | 247 |
| TK1 | 36 | KE-LB | Max | 15 | -17 | 40 | 737 | 1,524 | 3,050 |
| TK1 | 0 | KE-LB | Min | -16 | -90 | -42 | -679 | 0 | -276 |
| TK1 | 36 | KE-LB | Min | -16 | -88 | -42 | -679 | -1,427 | 694 |
| TK2 | 0 | KE-LB | Max | 1 | 93 | 45 | 771 | 1,610 | 3,368 |
| TK2 | 36 | KE-LB | Max | 1 | 95 | 45 | 771 | 0 | 0 |
| TK2 | 0 | KE-LB | Min | -1 | 19 | -46 | -759 | -1,644 | 721 |
| TK2 | 36 | KE-LB | Min | -1 | 21 | -46 | -759 | 0 | 0 |
| TK3 | 0 | KE-LB | Max | 1 | -20 | 36 | 618 | 0 | 0 |
| TK3 | 36 | KE-LB | Max | 1 | -18 | 36 | 618 | 1,268 | 3,087 |
| TK3 | 0 | KE-LB | Min | -1 | -87 | -35 | -620 | 0 | 0 |
| TK3 | 36 | KE-LB | Min | -1 | -85 | -35 | -620 | -1,299 | 670 |
| TK4 | 0 | KE-LB | Max | 1 | 85 | 38 | 673 | 1,377 | 3,109 |
| TK4 | 36 | KE-LB | Max | 1 | 87 | 38 | 673 | 0 | 0 |
| TK4 | 0 | KE-LB | Min | -1 | 22 | -39 | -672 | -1,400 | 825 |
| TK4 | 36 | KE-LB | Min | -1 | 24 | -39 | -672 | 0 | 0 |
| TK5 | 0 | KE-LB | Max | 21 | -22 | 2 | 0 | 0 | 359 |
| TK5 | 36 | KE-LB | Max | 21 | -20 | 2 | 0 | 49 | 3,444 |
| TK5 | 0 | KE-LB | Min | -25 | -99 | -1 | -1 | 0 | -431 |
| TK5 | 36 | KE-LB | Min | -25 | -97 | -1 | -1 | -62 | 726 |
| TK6 | 0 | KE-LB | Max | 1 | 103 | 1 | 0 | 51 | 3,734 |
| TK6 | 36 | KE-LB | Max | 1 | 105 | 1 | 0 | 0 | 0 |
| TK6 | 0 | KE-LB | Min | -1 | 21 | -2 | 0 | -62 | 774 |
| TK6 | 36 | KE-LB | Min | -1 | 22 | -2 | 0 | 0 | 0 |
| TK7 | 0 | KE-LB | Max | 1 | -21 | 2 | 0 | 0 | 0 |
| TK7 | 36 | KE-LB | Max | 1 | -19 | 2 | 0 | 52 | 3,469 |
| TK7 | 0 | KE-LB | Min | -1 | -97 | -1 | 0 | 0 | 0 |
| TK7 | 36 | KE-LB | Min | -1 | -95 | -1 | 0 | -62 | 717 |
| TK8 | 0 | KE-LB | Max | 1 | 97 | 1 | 0 | 51 | 3,531 |
| TK8 | 36 | KE-LB | Max | 1 | 99 | 1 | 0 | 0 | 0 |
| TK8 | 0 | KE-LB | Min | -1 | 22 | -1 | 0 | -53 | 835 |
| TK8 | 36 | KE-LB | Min | -1 | 24 | -1 | 0 | 0 | 0 |
| | | **Trucks** | **Max:** | **21** | **105** | **45** | **771** | **1,610** | **3,734** |
| | | **KE-LB** | **Min:** | **-25** | **-99** | **-46** | **-759** | **-1,644** | **-431** |
| | | | **Abs:** | **25** | **105** | **46** | **771** | **1,644** | **3,734** |

## M.5 Parametric Analysis – Ke = 2 x Ke (KE-UB)

### M.5.1 KE-UB -Girders

| M.5.1 Ke-UB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | KE-UB | Max | 73 | -43 | 9 | 503 | 2,466 | 423 |
| G01 | 146 | KE-UB | Max | 73 | -36 | 9 | 503 | 1,109 | 24,432 |
| G01 | 0 | KE-UB | Min | -75 | -169 | -10 | -451 | -2,322 | -477 |
| G01 | 146 | KE-UB | Min | -75 | -163 | -10 | -451 | -936 | 5,601 |
| G02 | 0 | KE-UB | Max | 63 | -37 | 12 | 503 | 1,109 | 24,432 |
| G02 | 138 | KE-UB | Max | 63 | -31 | 12 | 503 | 566 | 46,281 |
| G02 | 0 | KE-UB | Min | -65 | -161 | -11 | -451 | -936 | 5,601 |
| G02 | 138 | KE-UB | Min | -65 | -155 | -11 | -451 | -526 | 10,292 |
| G03 | 0 | KE-UB | Max | 53 | -32 | 11 | 503 | 566 | 46,281 |
| G03 | 174.5 | KE-UB | Max | 53 | -24 | 11 | 503 | 2,147 | 72,302 |
| G03 | 0 | KE-UB | Min | -58 | -153 | -10 | -451 | -526 | 10,292 |
| G03 | 174.5 | KE-UB | Min | -58 | -145 | -10 | -451 | -2,457 | 15,244 |
| G04 | 0 | KE-UB | Max | 48 | 15 | 1 | 110 | 2,147 | 72,536 |
| G04 | 36.5 | KE-UB | Max | 48 | 16 | 1 | 110 | 2,116 | 72,028 |
| G04 | 0 | KE-UB | Min | -44 | 2 | -1 | -153 | -2,457 | 14,920 |
| G04 | 36.5 | KE-UB | Min | -44 | 4 | -1 | -153 | -2,418 | 14,787 |
| G05 | 0 | KE-UB | Max | 43 | 17 | 2 | 110 | 2,116 | 72,028 |
| G05 | 138 | KE-UB | Max | 43 | 22 | 2 | 110 | 1,918 | 70,013 |
| G05 | 0 | KE-UB | Min | -40 | 3 | -2 | -153 | -2,418 | 14,787 |
| G05 | 138 | KE-UB | Min | -40 | 8 | -2 | -153 | -2,174 | 14,149 |
| G06 | 0 | KE-UB | Max | 37 | 170 | 10 | 500 | 1,918 | 70,013 |
| G06 | 73 | KE-UB | Max | 37 | 175 | 10 | 500 | 1,071 | 52,532 |
| G06 | 0 | KE-UB | Min | -34 | 29 | -11 | -566 | -2,174 | 14,149 |
| G06 | 73 | KE-UB | Min | -34 | 34 | -11 | -566 | -1,127 | 10,977 |
| G07 | 0 | KE-UB | Max | 30 | 176 | 10 | 500 | 1,071 | 52,532 |
| G07 | 146 | KE-UB | Max | 30 | 182 | 10 | 500 | 574 | 27,797 |
| G07 | 0 | KE-UB | Min | -28 | 32 | -11 | -566 | -1,127 | 10,977 |
| G07 | 146 | KE-UB | Min | -28 | 38 | -11 | -566 | -469 | 6,119 |
| G08 | 0 | KE-UB | Max | 22 | 184 | 9 | 500 | 574 | 27,797 |
| G08 | 138 | KE-UB | Max | 22 | 190 | 9 | 500 | 1,759 | 723 |
| G08 | 0 | KE-UB | Min | -20 | 37 | -9 | -566 | -469 | 6,119 |
| G08 | 138 | KE-UB | Min | -20 | 44 | -9 | -566 | -1,618 | -705 |
| G09 | 0 | KE-UB | Max | 63 | -41 | 10 | 497 | 2,464 | 492 |
| G09 | 146 | KE-UB | Max | 63 | -35 | 10 | 497 | 1,074 | 23,787 |
| G09 | 0 | KE-UB | Min | -61 | -168 | -10 | -451 | -2,313 | -490 |
| G09 | 146 | KE-UB | Min | -61 | -162 | -10 | -451 | -923 | 5,454 |
| G10 | 0 | KE-UB | Max | 54 | -36 | 11 | 497 | 1,074 | 23,787 |
| G10 | 138 | KE-UB | Max | 54 | -30 | 11 | 497 | 529 | 45,573 |
| G10 | 0 | KE-UB | Min | -52 | -161 | -10 | -451 | -923 | 5,454 |
| G10 | 138 | KE-UB | Min | -52 | -155 | -10 | -451 | -531 | 10,038 |
| G11 | 0 | KE-UB | Max | 46 | -32 | 11 | 497 | 529 | 45,573 |
| G11 | 174.5 | KE-UB | Max | 46 | -25 | 11 | 497 | 2,141 | 71,719 |
| G11 | 0 | KE-UB | Min | -46 | -153 | -10 | -451 | -531 | 10,038 |
| G11 | 174.5 | KE-UB | Min | -46 | -146 | -10 | -451 | -2,430 | 14,997 |
| G12 | 0 | KE-UB | Max | 34 | 15 | 2 | 132 | 2,141 | 71,928 |

| M.5.1 Ke-UB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G12 | 36.5 | KE-UB | Max | 34 | 17 | 2 | 132 | 2,109 | 71,374 |
| G12 | 0 | KE-UB | Min | -38 | 3 | -2 | -144 | -2,430 | 14,835 |
| G12 | 36.5 | KE-UB | Min | -38 | 5 | -2 | -144 | -2,392 | 14,671 |
| G13 | 0 | KE-UB | Max | 30 | 17 | 2 | 132 | 2,109 | 71,374 |
| G13 | 138 | KE-UB | Max | 30 | 22 | 2 | 132 | 1,915 | 69,275 |
| G13 | 0 | KE-UB | Min | -34 | 3 | -3 | -144 | -2,392 | 14,671 |
| G13 | 138 | KE-UB | Min | -34 | 8 | -3 | -144 | -2,165 | 13,974 |
| G14 | 0 | KE-UB | Max | 25 | 172 | 10 | 497 | 1,915 | 69,275 |
| G14 | 73 | KE-UB | Max | 25 | 176 | 10 | 497 | 1,060 | 51,656 |
| G14 | 0 | KE-UB | Min | -29 | 30 | -11 | -549 | -2,165 | 13,974 |
| G14 | 73 | KE-UB | Min | -29 | 34 | -11 | -549 | -1,118 | 10,709 |
| G15 | 0 | KE-UB | Max | 21 | 177 | 10 | 497 | 1,060 | 51,656 |
| G15 | 146 | KE-UB | Max | 21 | 183 | 10 | 497 | 544 | 26,833 |
| G15 | 0 | KE-UB | Min | -22 | 33 | -11 | -549 | -1,118 | 10,709 |
| G15 | 146 | KE-UB | Min | -22 | 38 | -11 | -549 | -443 | 5,811 |
| G16 | 0 | KE-UB | Max | 17 | 184 | 9 | 497 | 544 | 26,833 |
| G16 | 138 | KE-UB | Max | 17 | 190 | 9 | 497 | 1,748 | 731 |
| G16 | 0 | KE-UB | Min | -18 | 37 | -9 | -549 | -443 | 5,811 |
| G16 | 138 | KE-UB | Min | -18 | 43 | -9 | -549 | -1,578 | -621 |
| | | **Girder** | **Max:** | **73** | **190** | **12** | **503** | **2,466** | **72,536** |
| | | **KE-UB** | **Min:** | **-75** | **-169** | **-11** | **-566** | **-2,457** | **-705** |
| | | | **Abs:** | **75** | **190** | **12** | **566** | **2,466** | **72,536** |

## M.5.2 KE-UB -End Ties

| M.5.2 Ke-UB: Element Forces - Frames - End Ties | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| End Tie | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | KE-UB | Max | 8 | -1 | 8 | 0 | 995 | -26 |
| ET1 | 120 | KE-UB | Max | 8 | 0 | 8 | 0 | 66 | 54 |
| ET1 | 0 | KE-UB | Min | -8 | -2 | -9 | 0 | -1,066 | -79 |
| ET1 | 120 | KE-UB | Min | -8 | 0 | -9 | 0 | -68 | -1 |
| ET2 | 0 | KE-UB | Max | 7 | 0 | 9 | 0 | 66 | 54 |
| ET2 | 120 | KE-UB | Max | 7 | 2 | 9 | 0 | 1,044 | -23 |
| ET2 | 0 | KE-UB | Min | -8 | 0 | -9 | 0 | -68 | -1 |
| ET2 | 120 | KE-UB | Min | -8 | 1 | -9 | 0 | -1,020 | -83 |
| ET3 | 0 | KE-UB | Max | 10 | -1 | 15 | 0 | 1,764 | -24 |
| ET3 | 120 | KE-UB | Max | 10 | 0 | 15 | 0 | 130 | 57 |
| ET3 | 0 | KE-UB | Min | -12 | -2 | -14 | 0 | -1,618 | -82 |
| ET3 | 120 | KE-UB | Min | -12 | -1 | -14 | 0 | -106 | -3 |
| ET4 | 0 | KE-UB | Max | 9 | 1 | 15 | 0 | 130 | 57 |
| ET4 | 120 | KE-UB | Max | 9 | 2 | 15 | 0 | 1,581 | -21 |
| ET4 | 0 | KE-UB | Min | -11 | -1 | -13 | 0 | -106 | -3 |
| ET4 | 120 | KE-UB | Min | -11 | 1 | -13 | 0 | -1,753 | -86 |
| | | **End Tie** | **Max:** | **10** | **2** | **15** | **0** | **1,764** | **57** |
| | | **KE-UB** | **Min:** | **-12** | **-2** | **-14** | **0** | **-1,753** | **-86** |
| | | | **Abs:** | **12** | **2** | **15** | **0** | **1,764** | **86** |

## M.5.3 KE-UB -Trucks

| M.5.3 Ke-UB: Element Forces - Frames - Trucks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | KE-UB | Max | 14 | -19 | 39 | 735 | 0 | 253 |
| TK1 | 36 | KE-UB | Max | 14 | -17 | 39 | 735 | 1,527 | 3,048 |
| TK1 | 0 | KE-UB | Min | -16 | -90 | -42 | -675 | 0 | -270 |
| TK1 | 36 | KE-UB | Min | -16 | -88 | -42 | -675 | -1,421 | 693 |
| TK2 | 0 | KE-UB | Max | 1 | 93 | 45 | 772 | 1,605 | 3,366 |
| TK2 | 36 | KE-UB | Max | 1 | 94 | 45 | 772 | 0 | 0 |
| TK2 | 0 | KE-UB | Min | -1 | 19 | -46 | -757 | -1,644 | 734 |
| TK2 | 36 | KE-UB | Min | -1 | 21 | -46 | -757 | 0 | 0 |
| TK3 | 0 | KE-UB | Max | 1 | -19 | 36 | 614 | 0 | 0 |
| TK3 | 36 | KE-UB | Max | 1 | -18 | 36 | 614 | 1,262 | 3,090 |
| TK3 | 0 | KE-UB | Min | -1 | -87 | -35 | -617 | 0 | 0 |
| TK3 | 36 | KE-UB | Min | -1 | -85 | -35 | -617 | -1,294 | 666 |
| TK4 | 0 | KE-UB | Max | 1 | 86 | 39 | 672 | 1,390 | 3,120 |
| TK4 | 36 | KE-UB | Max | 1 | 88 | 39 | 672 | 0 | 0 |
| TK4 | 0 | KE-UB | Min | -1 | 22 | -39 | -680 | -1,397 | 824 |
| TK4 | 36 | KE-UB | Min | -1 | 24 | -39 | -680 | 0 | 0 |
| TK5 | 0 | KE-UB | Max | 21 | -22 | 2 | 0 | 0 | 363 |
| TK5 | 36 | KE-UB | Max | 21 | -20 | 2 | 0 | 49 | 3,441 |
| TK5 | 0 | KE-UB | Min | -25 | -99 | -1 | -1 | 0 | -427 |
| TK5 | 36 | KE-UB | Min | -25 | -97 | -1 | -1 | -62 | 727 |
| TK6 | 0 | KE-UB | Max | 1 | 103 | 1 | 0 | 51 | 3,738 |
| TK6 | 36 | KE-UB | Max | 1 | 105 | 1 | 0 | 0 | 0 |
| TK6 | 0 | KE-UB | Min | -1 | 20 | -2 | 0 | -62 | 769 |
| TK6 | 36 | KE-UB | Min | -1 | 22 | -2 | 0 | 0 | 0 |
| TK7 | 0 | KE-UB | Max | 1 | -21 | 2 | 0 | 0 | 0 |
| TK7 | 36 | KE-UB | Max | 1 | -19 | 2 | 0 | 52 | 3,471 |
| TK7 | 0 | KE-UB | Min | -1 | -97 | -1 | 0 | 0 | 0 |
| TK7 | 36 | KE-UB | Min | -1 | -95 | -1 | 0 | -63 | 716 |
| TK8 | 0 | KE-UB | Max | 1 | 97 | 1 | 0 | 50 | 3,544 |
| TK8 | 36 | KE-UB | Max | 1 | 99 | 1 | 0 | 0 | 0 |
| TK8 | 0 | KE-UB | Min | -1 | 22 | -1 | 0 | -54 | 837 |
| TK8 | 36 | KE-UB | Min | -1 | 24 | -1 | 0 | 0 | 0 |
| | | **Trucks** | **Max:** | **21** | **105** | **45** | **772** | **1,605** | **3,738** |
| | | **KE-UB** | **Min:** | **-25** | **-99** | **-46** | **-757** | **-1,644** | **-427** |
| | | | **Abs:** | **25** | **105** | **46** | **772** | **1,644** | **3,738** |

## M.6 Parametric Analysis – K = K / 2 (K-LB)

### M.6.1 K-LB -Girders

| M.6.1 K-LB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | K-LB | Max | 73 | -42 | 10 | 514 | 2,545 | 412 |
| G01 | 146 | K-LB | Max | 73 | -36 | 10 | 514 | 1,141 | 24,414 |
| G01 | 0 | K-LB | Min | -71 | -169 | -9 | -454 | -2,137 | -501 |
| G01 | 146 | K-LB | Min | -71 | -163 | -9 | -454 | -910 | 5,588 |
| G02 | 0 | K-LB | Max | 63 | -37 | 12 | 514 | 1,141 | 24,414 |
| G02 | 138 | K-LB | Max | 63 | -30 | 12 | 514 | 576 | 46,279 |
| G02 | 0 | K-LB | Min | -64 | -162 | -10 | -454 | -910 | 5,588 |
| G02 | 138 | K-LB | Min | -64 | -155 | -10 | -454 | -534 | 10,195 |
| G03 | 0 | K-LB | Max | 53 | -32 | 12 | 514 | 576 | 46,279 |
| G03 | 174.5 | K-LB | Max | 53 | -25 | 12 | 514 | 2,167 | 72,320 |
| G03 | 0 | K-LB | Min | -54 | -153 | -10 | -454 | -534 | 10,195 |
| G03 | 174.5 | K-LB | Min | -54 | -145 | -10 | -454 | -2,477 | 15,170 |
| G04 | 0 | K-LB | Max | 48 | 14 | 1 | 106 | 2,167 | 72,555 |
| G04 | 36.5 | K-LB | Max | 48 | 16 | 1 | 106 | 2,119 | 72,045 |
| G04 | 0 | K-LB | Min | -44 | 2 | -1 | -165 | -2,477 | 14,923 |
| G04 | 36.5 | K-LB | Min | -44 | 4 | -1 | -165 | -2,433 | 14,804 |
| G05 | 0 | K-LB | Max | 44 | 17 | 2 | 106 | 2,119 | 72,045 |
| G05 | 138 | K-LB | Max | 44 | 21 | 2 | 106 | 1,880 | 70,018 |
| G05 | 0 | K-LB | Min | -39 | 3 | -2 | -165 | -2,433 | 14,804 |
| G05 | 138 | K-LB | Min | -39 | 8 | -2 | -165 | -2,164 | 14,216 |
| G06 | 0 | K-LB | Max | 38 | 170 | 10 | 514 | 1,880 | 70,018 |
| G06 | 73 | K-LB | Max | 38 | 175 | 10 | 514 | 974 | 52,524 |
| G06 | 0 | K-LB | Min | -33 | 29 | -11 | -578 | -2,164 | 14,216 |
| G06 | 73 | K-LB | Min | -33 | 33 | -11 | -578 | -1,145 | 11,067 |
| G07 | 0 | K-LB | Max | 31 | 176 | 10 | 514 | 974 | 52,524 |
| G07 | 146 | K-LB | Max | 31 | 182 | 10 | 514 | 561 | 27,780 |
| G07 | 0 | K-LB | Min | -27 | 32 | -11 | -578 | -1,145 | 11,067 |
| G07 | 146 | K-LB | Min | -27 | 38 | -11 | -578 | -509 | 6,193 |
| G08 | 0 | K-LB | Max | 22 | 183 | 9 | 514 | 561 | 27,780 |
| G08 | 138 | K-LB | Max | 22 | 190 | 9 | 514 | 1,730 | 702 |
| G08 | 0 | K-LB | Min | -19 | 38 | -9 | -578 | -509 | 6,193 |
| G08 | 138 | K-LB | Min | -19 | 44 | -9 | -578 | -1,588 | -689 |
| G09 | 0 | K-LB | Max | 62 | -41 | 10 | 508 | 2,528 | 487 |
| G09 | 146 | K-LB | Max | 62 | -35 | 10 | 508 | 1,116 | 23,795 |
| G09 | 0 | K-LB | Min | -61 | -168 | -9 | -457 | -2,144 | -462 |
| G09 | 146 | K-LB | Min | -61 | -162 | -9 | -457 | -897 | 5,453 |
| G10 | 0 | K-LB | Max | 54 | -36 | 12 | 508 | 1,116 | 23,795 |
| G10 | 138 | K-LB | Max | 54 | -30 | 12 | 508 | 546 | 45,582 |
| G10 | 0 | K-LB | Min | -53 | -161 | -10 | -457 | -897 | 5,453 |
| G10 | 138 | K-LB | Min | -53 | -155 | -10 | -457 | -517 | 10,013 |
| G11 | 0 | K-LB | Max | 45 | -32 | 11 | 508 | 546 | 45,582 |
| G11 | 174.5 | K-LB | Max | 45 | -25 | 11 | 508 | 2,157 | 71,717 |
| G11 | 0 | K-LB | Min | -43 | -153 | -10 | -457 | -517 | 10,013 |
| G11 | 174.5 | K-LB | Min | -43 | -146 | -10 | -457 | -2,458 | 15,002 |
| G12 | 0 | K-LB | Max | 35 | 15 | 2 | 118 | 2,157 | 71,941 |

| M.6.1 K-LB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G12 | 36.5 | K-LB | Max | 35 | 17 | 2 | 118 | 2,106 | 71,380 |
| G12 | 0 | K-LB | Min | -35 | 3 | -2 | -147 | -2,458 | 14,785 |
| G12 | 36.5 | K-LB | Min | -35 | 5 | -2 | -147 | -2,409 | 14,641 |
| G13 | 0 | K-LB | Max | 31 | 17 | 2 | 118 | 2,106 | 71,380 |
| G13 | 138 | K-LB | Max | 31 | 22 | 2 | 118 | 1,877 | 69,261 |
| G13 | 0 | K-LB | Min | -31 | 4 | -2 | -147 | -2,409 | 14,641 |
| G13 | 138 | K-LB | Min | -31 | 8 | -2 | -147 | -2,146 | 14,007 |
| G14 | 0 | K-LB | Max | 25 | 172 | 10 | 503 | 1,877 | 69,261 |
| G14 | 73 | K-LB | Max | 25 | 176 | 10 | 503 | 977 | 51,618 |
| G14 | 0 | K-LB | Min | -24 | 30 | -11 | -563 | -2,146 | 14,007 |
| G14 | 73 | K-LB | Min | -24 | 34 | -11 | -563 | -1,124 | 10,776 |
| G15 | 0 | K-LB | Max | 20 | 177 | 10 | 503 | 977 | 51,618 |
| G15 | 146 | K-LB | Max | 20 | 183 | 10 | 503 | 507 | 26,785 |
| G15 | 0 | K-LB | Min | -20 | 33 | -11 | -563 | -1,124 | 10,776 |
| G15 | 146 | K-LB | Min | -20 | 38 | -11 | -563 | -465 | 5,848 |
| G16 | 0 | K-LB | Max | 17 | 184 | 9 | 503 | 507 | 26,785 |
| G16 | 138 | K-LB | Max | 17 | 190 | 9 | 503 | 1,718 | 711 |
| G16 | 0 | K-LB | Min | -18 | 38 | -9 | -563 | -465 | 5,848 |
| G16 | 138 | K-LB | Min | -18 | 44 | -9 | -563 | -1,564 | -601 |
| | | **Girder** | **Max:** | **73** | **190** | **12** | **514** | **2,545** | **72,555** |
| | | **K-LB** | **Min:** | **-71** | **-169** | **-11** | **-578** | **-2,477** | **-689** |
| | | | **Abs:** | **73** | **190** | **12** | **578** | **2,545** | **72,555** |

## M.6.2 K-LB -End Ties

| M.6.2 K-LB: Element Forces - Frames - End Ties | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| End Tie | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | K-LB | Max | 8 | -1 | 7 | 0 | 919 | -25 |
| ET1 | 120 | K-LB | Max | 8 | 0 | 7 | 0 | 66 | 50 |
| ET1 | 0 | K-LB | Min | -8 | -2 | -9 | 0 | -1,099 | -75 |
| ET1 | 120 | K-LB | Min | -8 | 0 | -9 | 0 | -70 | -1 |
| ET2 | 0 | K-LB | Max | 7 | 0 | 8 | 0 | 66 | 50 |
| ET2 | 120 | K-LB | Max | 7 | 2 | 8 | 0 | 1,071 | -23 |
| ET2 | 0 | K-LB | Min | -7 | 0 | -9 | 0 | -70 | -1 |
| ET2 | 120 | K-LB | Min | -7 | 1 | -9 | 0 | -951 | -78 |
| ET3 | 0 | K-LB | Max | 10 | -1 | 15 | 0 | 1,735 | -24 |
| ET3 | 120 | K-LB | Max | 10 | 0 | 15 | 0 | 109 | 53 |
| ET3 | 0 | K-LB | Min | -11 | -2 | -14 | 0 | -1,590 | -78 |
| ET3 | 120 | K-LB | Min | -11 | 0 | -14 | 0 | -89 | -3 |
| ET4 | 0 | K-LB | Max | 9 | 0 | 14 | 0 | 109 | 53 |
| ET4 | 120 | K-LB | Max | 9 | 2 | 14 | 0 | 1,566 | -21 |
| ET4 | 0 | K-LB | Min | -10 | -1 | -13 | 0 | -89 | -3 |
| ET4 | 120 | K-LB | Min | -10 | 1 | -13 | 0 | -1,723 | -82 |
| | | **End Tie** | **Max:** | **10** | **2** | **15** | **0** | **1,735** | **53** |
| | | **K-LB** | **Min:** | **-11** | **-2** | **-14** | **0** | **-1,723** | **-82** |
| | | | **Abs:** | **11** | **2** | **15** | **0** | **1,735** | **82** |

## M.6.3 K-LB -Trucks

| M.6.3 K-LB: Element Forces - Frames - Trucks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | K-LB | Max | 14 | -20 | 39 | 705 | 0 | 250 |
| TK1 | 36 | K-LB | Max | 14 | -18 | 39 | 705 | 1,442 | 3,044 |
| TK1 | 0 | K-LB | Min | -14 | -90 | -40 | -678 | 0 | -250 |
| TK1 | 36 | K-LB | Min | -14 | -88 | -40 | -678 | -1,420 | 706 |
| TK2 | 0 | K-LB | Max | 1 | 92 | 45 | 770 | 1,611 | 3,359 |
| TK2 | 36 | K-LB | Max | 1 | 94 | 45 | 770 | 0 | 0 |
| TK2 | 0 | K-LB | Min | -1 | 20 | -46 | -751 | -1,648 | 749 |
| TK2 | 36 | K-LB | Min | -1 | 22 | -46 | -751 | 0 | 0 |
| TK3 | 0 | K-LB | Max | 1 | -20 | 36 | 625 | 0 | 0 |
| TK3 | 36 | K-LB | Max | 1 | -18 | 36 | 625 | 1,269 | 3,084 |
| TK3 | 0 | K-LB | Min | -1 | -87 | -35 | -618 | 0 | 0 |
| TK3 | 36 | K-LB | Min | -1 | -85 | -35 | -618 | -1,290 | 697 |
| TK4 | 0 | K-LB | Max | 1 | 85 | 38 | 668 | 1,379 | 3,091 |
| TK4 | 36 | K-LB | Max | 1 | 87 | 38 | 668 | 0 | 0 |
| TK4 | 0 | K-LB | Min | -1 | 22 | -39 | -666 | -1,387 | 817 |
| TK4 | 36 | K-LB | Min | -1 | 24 | -39 | -666 | 0 | 0 |
| TK5 | 0 | K-LB | Max | 20 | -21 | 2 | 0 | 0 | 349 |
| TK5 | 36 | K-LB | Max | 20 | -19 | 2 | 0 | 51 | 3,438 |
| TK5 | 0 | K-LB | Min | -23 | -99 | -1 | 0 | 0 | -394 |
| TK5 | 36 | K-LB | Min | -23 | -97 | -1 | 0 | -55 | 723 |
| TK6 | 0 | K-LB | Max | 1 | 103 | 1 | 0 | 53 | 3,735 |
| TK6 | 36 | K-LB | Max | 1 | 105 | 1 | 0 | 0 | 0 |
| TK6 | 0 | K-LB | Min | -1 | 20 | -1 | 0 | -53 | 754 |
| TK6 | 36 | K-LB | Min | -1 | 22 | -1 | 0 | 0 | 0 |
| TK7 | 0 | K-LB | Max | 1 | -21 | 1 | 0 | 0 | 0 |
| TK7 | 36 | K-LB | Max | 1 | -19 | 1 | 0 | 50 | 3,462 |
| TK7 | 0 | K-LB | Min | -1 | -97 | -1 | 0 | 0 | 0 |
| TK7 | 36 | K-LB | Min | -1 | -95 | -1 | 0 | -51 | 712 |
| TK8 | 0 | K-LB | Max | 1 | 97 | 1 | 0 | 52 | 3,541 |
| TK8 | 36 | K-LB | Max | 1 | 99 | 1 | 0 | 0 | 0 |
| TK8 | 0 | K-LB | Min | -1 | 22 | -1 | 0 | -51 | 831 |
| TK8 | 36 | K-LB | Min | -1 | 24 | -1 | 0 | 0 | 0 |
| | | **Trucks** | **Max:** | **20** | **105** | **45** | **770** | **1,611** | **3,735** |
| | | **K-LB** | **Min:** | **-23** | **-99** | **-46** | **-751** | **-1,648** | **-394** |
| | | | **Abs:** | **23** | **105** | **46** | **770** | **1,648** | **3,735** |

## M.7 Parametric Analysis – K = 2 x K (K-UB)

### M.7.1 K-UB -Girders

| M.7.1 K-UB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | K-UB | Max | 73 | -42 | 10 | 493 | 2,510 | 418 |
| G01 | 146 | K-UB | Max | 73 | -36 | 10 | 493 | 1,090 | 24,428 |
| G01 | 0 | K-UB | Min | -77 | -169 | -10 | -430 | -2,319 | -499 |
| G01 | 146 | K-UB | Min | -77 | -163 | -10 | -430 | -926 | 5,625 |
| G02 | 0 | K-UB | Max | 63 | -37 | 12 | 493 | 1,090 | 24,428 |
| G02 | 138 | K-UB | Max | 63 | -31 | 12 | 493 | 556 | 46,254 |
| G02 | 0 | K-UB | Min | -68 | -161 | -10 | -430 | -926 | 5,625 |
| G02 | 138 | K-UB | Min | -68 | -155 | -10 | -430 | -531 | 10,277 |
| G03 | 0 | K-UB | Max | 53 | -32 | 11 | 493 | 556 | 46,254 |
| G03 | 174.5 | K-UB | Max | 53 | -24 | 11 | 493 | 2,160 | 72,273 |
| G03 | 0 | K-UB | Min | -57 | -153 | -10 | -430 | -531 | 10,277 |
| G03 | 174.5 | K-UB | Min | -57 | -145 | -10 | -430 | -2,456 | 15,232 |
| G04 | 0 | K-UB | Max | 46 | 15 | 1 | 137 | 2,160 | 72,492 |
| G04 | 36.5 | K-UB | Max | 46 | 16 | 1 | 137 | 2,121 | 71,992 |
| G04 | 0 | K-UB | Min | -46 | 2 | -1 | -127 | -2,456 | 14,978 |
| G04 | 36.5 | K-UB | Min | -46 | 4 | -1 | -127 | -2,419 | 14,840 |
| G05 | 0 | K-UB | Max | 42 | 17 | 2 | 137 | 2,121 | 71,992 |
| G05 | 138 | K-UB | Max | 42 | 22 | 2 | 137 | 1,973 | 70,007 |
| G05 | 0 | K-UB | Min | -41 | 3 | -2 | -127 | -2,419 | 14,840 |
| G05 | 138 | K-UB | Min | -41 | 8 | -2 | -127 | -2,182 | 14,182 |
| G06 | 0 | K-UB | Max | 36 | 170 | 10 | 486 | 1,973 | 70,007 |
| G06 | 73 | K-UB | Max | 36 | 174 | 10 | 486 | 1,092 | 52,559 |
| G06 | 0 | K-UB | Min | -34 | 29 | -11 | -553 | -2,182 | 14,182 |
| G06 | 73 | K-UB | Min | -34 | 34 | -11 | -553 | -1,101 | 10,981 |
| G07 | 0 | K-UB | Max | 30 | 176 | 10 | 486 | 1,092 | 52,559 |
| G07 | 146 | K-UB | Max | 30 | 182 | 10 | 486 | 554 | 27,841 |
| G07 | 0 | K-UB | Min | -27 | 32 | -11 | -553 | -1,101 | 10,981 |
| G07 | 146 | K-UB | Min | -27 | 38 | -11 | -553 | -446 | 6,105 |
| G08 | 0 | K-UB | Max | 21 | 184 | 9 | 486 | 554 | 27,841 |
| G08 | 138 | K-UB | Max | 21 | 191 | 9 | 486 | 1,746 | 731 |
| G08 | 0 | K-UB | Min | -20 | 37 | -9 | -553 | -446 | 6,105 |
| G08 | 138 | K-UB | Min | -20 | 44 | -9 | -553 | -1,639 | -681 |
| G09 | 0 | K-UB | Max | 64 | -41 | 10 | 492 | 2,504 | 493 |
| G09 | 146 | K-UB | Max | 64 | -35 | 10 | 492 | 1,057 | 23,801 |
| G09 | 0 | K-UB | Min | -62 | -168 | -10 | -433 | -2,315 | -491 |
| G09 | 146 | K-UB | Min | -62 | -162 | -10 | -433 | -921 | 5,430 |
| G10 | 0 | K-UB | Max | 55 | -36 | 12 | 492 | 1,057 | 23,801 |
| G10 | 138 | K-UB | Max | 55 | -31 | 12 | 492 | 522 | 45,569 |
| G10 | 0 | K-UB | Min | -55 | -161 | -10 | -433 | -921 | 5,430 |
| G10 | 138 | K-UB | Min | -55 | -155 | -10 | -433 | -537 | 10,028 |
| G11 | 0 | K-UB | Max | 46 | -32 | 11 | 492 | 522 | 45,569 |
| G11 | 174.5 | K-UB | Max | 46 | -25 | 11 | 492 | 2,165 | 71,707 |
| G11 | 0 | K-UB | Min | -47 | -153 | -10 | -433 | -537 | 10,028 |
| G11 | 174.5 | K-UB | Min | -47 | -146 | -10 | -433 | -2,431 | 15,014 |
| G12 | 0 | K-UB | Max | 34 | 15 | 1 | 121 | 2,165 | 71,912 |

| M.7.1 K-UB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G12 | 36.5 | K-UB | Max | 34 | 17 | 1 | 121 | 2,119 | 71,365 |
| G12 | 0 | K-UB | Min | -38 | 3 | -2 | -129 | -2,431 | 14,830 |
| G12 | 36.5 | K-UB | Min | -38 | 5 | -2 | -129 | -2,395 | 14,666 |
| G13 | 0 | K-UB | Max | 30 | 18 | 2 | 121 | 2,119 | 71,365 |
| G13 | 138 | K-UB | Max | 30 | 22 | 2 | 121 | 1,948 | 69,293 |
| G13 | 0 | K-UB | Min | -35 | 3 | -2 | -129 | -2,395 | 14,666 |
| G13 | 138 | K-UB | Min | -35 | 8 | -2 | -129 | -2,175 | 13,963 |
| G14 | 0 | K-UB | Max | 26 | 171 | 10 | 490 | 1,948 | 69,293 |
| G14 | 73 | K-UB | Max | 26 | 175 | 10 | 490 | 1,074 | 51,702 |
| G14 | 0 | K-UB | Min | -29 | 30 | -11 | -544 | -2,175 | 13,963 |
| G14 | 73 | K-UB | Min | -29 | 34 | -11 | -544 | -1,097 | 10,680 |
| G15 | 0 | K-UB | Max | 21 | 177 | 10 | 490 | 1,074 | 51,702 |
| G15 | 146 | K-UB | Max | 21 | 183 | 10 | 490 | 513 | 26,891 |
| G15 | 0 | K-UB | Min | -22 | 33 | -11 | -544 | -1,097 | 10,680 |
| G15 | 146 | K-UB | Min | -22 | 38 | -11 | -544 | -433 | 5,770 |
| G16 | 0 | K-UB | Max | 17 | 184 | 9 | 490 | 513 | 26,891 |
| G16 | 138 | K-UB | Max | 17 | 190 | 9 | 490 | 1,762 | 739 |
| G16 | 0 | K-UB | Min | -18 | 37 | -9 | -544 | -433 | 5,770 |
| G16 | 138 | K-UB | Min | -18 | 43 | -9 | -544 | -1,600 | -606 |
| | | **Girder** | **Max:** | **73** | **191** | **12** | **493** | **2,510** | **72,492** |
| | | **K-UB** | **Min:** | **-77** | **-169** | **-11** | **-553** | **-2,456** | **-681** |
| | | | **Abs:** | **77** | **191** | **12** | **553** | **2,510** | **72,492** |

## M.7.2 K-UB -End Ties

| M.7.2 K-UB: Element Forces - Frames - End Ties | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| End Tie | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | K-UB | Max | 8 | -1 | 8 | 0 | 996 | -20 |
| ET1 | 120 | K-UB | Max | 8 | 1 | 8 | 0 | 67 | 56 |
| ET1 | 0 | K-UB | Min | -9 | -2 | -9 | 0 | -1,086 | -84 |
| ET1 | 120 | K-UB | Min | -9 | -1 | -9 | 0 | -67 | -6 |
| ET2 | 0 | K-UB | Max | 7 | 0 | 9 | 0 | 67 | 56 |
| ET2 | 120 | K-UB | Max | 7 | 2 | 9 | 0 | 1,063 | -19 |
| ET2 | 0 | K-UB | Min | -8 | -1 | -9 | 0 | -67 | -6 |
| ET2 | 120 | K-UB | Min | -8 | 1 | -9 | 0 | -1,028 | -82 |
| ET3 | 0 | K-UB | Max | 11 | -1 | 14 | 0 | 1,749 | -19 |
| ET3 | 120 | K-UB | Max | 11 | 1 | 14 | 0 | 133 | 55 |
| ET3 | 0 | K-UB | Min | -12 | -2 | -14 | 0 | -1,641 | -82 |
| ET3 | 120 | K-UB | Min | -12 | 0 | -14 | 0 | -99 | -7 |
| ET4 | 0 | K-UB | Max | 10 | 0 | 15 | 0 | 133 | 55 |
| ET4 | 120 | K-UB | Max | 10 | 2 | 15 | 0 | 1,604 | -18 |
| ET4 | 0 | K-UB | Min | -10 | -1 | -13 | 0 | -99 | -7 |
| ET4 | 120 | K-UB | Min | -10 | 1 | -13 | 0 | -1,765 | -82 |
| | | **End Tie** | **Max:** | **11** | **2** | **15** | **0** | **1,749** | **56** |
| | | **K-UB** | **Min:** | **-12** | **-2** | **-14** | **0** | **-1,765** | **-84** |
| | | | **Abs:** | **12** | **2** | **15** | **0** | **1,765** | **84** |

## M.7.3 K-UB -Trucks

| M.7.3 K-UB: Element Forces - Frames - Trucks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | K-UB | Max | 15 | -19 | 39 | 717 | 0 | 258 |
| TK1 | 36 | K-UB | Max | 15 | -17 | 39 | 717 | 1,527 | 3,040 |
| TK1 | 0 | K-UB | Min | -17 | -89 | -42 | -671 | 0 | -295 |
| TK1 | 36 | K-UB | Min | -17 | -87 | -42 | -671 | -1,418 | 697 |
| TK2 | 0 | K-UB | Max | 1 | 93 | 44 | 763 | 1,589 | 3,367 |
| TK2 | 36 | K-UB | Max | 1 | 95 | 44 | 763 | 0 | 0 |
| TK2 | 0 | K-UB | Min | -1 | 20 | -45 | -757 | -1,618 | 767 |
| TK2 | 36 | K-UB | Min | -1 | 22 | -45 | -757 | 0 | 0 |
| TK3 | 0 | K-UB | Max | 1 | -20 | 36 | 621 | 0 | 0 |
| TK3 | 36 | K-UB | Max | 1 | -18 | 36 | 621 | 1,282 | 3,102 |
| TK3 | 0 | K-UB | Min | -1 | -87 | -36 | -622 | 0 | 0 |
| TK3 | 36 | K-UB | Min | -1 | -85 | -36 | -622 | -1,291 | 670 |
| TK4 | 0 | K-UB | Max | 1 | 86 | 39 | 667 | 1,393 | 3,127 |
| TK4 | 36 | K-UB | Max | 1 | 88 | 39 | 667 | 0 | 0 |
| TK4 | 0 | K-UB | Min | -1 | 22 | -39 | -689 | -1,388 | 828 |
| TK4 | 36 | K-UB | Min | -1 | 24 | -39 | -689 | 0 | 0 |
| TK5 | 0 | K-UB | Max | 21 | -22 | 2 | 0 | 0 | 369 |
| TK5 | 36 | K-UB | Max | 21 | -20 | 2 | 0 | 53 | 3,435 |
| TK5 | 0 | K-UB | Min | -24 | -99 | -1 | -1 | 0 | -411 |
| TK5 | 36 | K-UB | Min | -24 | -97 | -1 | -1 | -60 | 724 |
| TK6 | 0 | K-UB | Max | 1 | 103 | 1 | 0 | 53 | 3,757 |
| TK6 | 36 | K-UB | Max | 1 | 105 | 1 | 0 | 0 | 0 |
| TK6 | 0 | K-UB | Min | -1 | 20 | -2 | 0 | -60 | 746 |
| TK6 | 36 | K-UB | Min | -1 | 22 | -2 | 0 | 0 | 0 |
| TK7 | 0 | K-UB | Max | 1 | -21 | 2 | 0 | 0 | 0 |
| TK7 | 36 | K-UB | Max | 1 | -19 | 2 | 0 | 52 | 3,489 |
| TK7 | 0 | K-UB | Min | -1 | -98 | -1 | 0 | 0 | 0 |
| TK7 | 36 | K-UB | Min | -1 | -96 | -1 | 0 | -64 | 706 |
| TK8 | 0 | K-UB | Max | 1 | 97 | 1 | 0 | 49 | 3,542 |
| TK8 | 36 | K-UB | Max | 1 | 99 | 1 | 0 | 0 | 0 |
| TK8 | 0 | K-UB | Min | -1 | 23 | -2 | 0 | -54 | 879 |
| TK8 | 36 | K-UB | Min | -1 | 25 | -2 | 0 | 0 | 0 |
| | | **Trucks** | **Max:** | **21** | **105** | **44** | **763** | **1,589** | **3,757** |
| | | **K-UB** | **Min:** | **-24** | **-99** | **-45** | **-757** | **-1,618** | **-411** |
| | | | **Abs:** | **24** | **105** | **45** | **763** | **1,618** | **3,757** |

## M.8 Parametric Analysis – Exp = Exp / 2 (EXP-LB)

### M.8.1 EXP-LB -Girders

| M.8.1 EXP-LB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | EXP-LB | Max | 73 | -43 | 9 | 501 | 2,459 | 423 |
| G01 | 146 | EXP-LB | Max | 73 | -36 | 9 | 501 | 1,110 | 24,436 |
| G01 | 0 | EXP-LB | Min | -75 | -169 | -10 | -449 | -2,311 | -478 |
| G01 | 146 | EXP-LB | Min | -75 | -163 | -10 | -449 | -932 | 5,597 |
| G02 | 0 | EXP-LB | Max | 63 | -37 | 12 | 501 | 1,110 | 24,436 |
| G02 | 138 | EXP-LB | Max | 63 | -30 | 12 | 501 | 563 | 46,287 |
| G02 | 0 | EXP-LB | Min | -65 | -161 | -10 | -449 | -932 | 5,597 |
| G02 | 138 | EXP-LB | Min | -65 | -155 | -10 | -449 | -527 | 10,285 |
| G03 | 0 | EXP-LB | Max | 53 | -32 | 11 | 501 | 563 | 46,287 |
| G03 | 174.5 | EXP-LB | Max | 53 | -24 | 11 | 501 | 2,135 | 72,305 |
| G03 | 0 | EXP-LB | Min | -58 | -153 | -10 | -449 | -527 | 10,285 |
| G03 | 174.5 | EXP-LB | Min | -58 | -145 | -10 | -449 | -2,460 | 15,234 |
| G04 | 0 | EXP-LB | Max | 48 | 15 | 1 | 126 | 2,135 | 72,539 |
| G04 | 36.5 | EXP-LB | Max | 48 | 16 | 1 | 126 | 2,105 | 72,030 |
| G04 | 0 | EXP-LB | Min | -44 | 3 | -1 | -154 | -2,460 | 14,915 |
| G04 | 36.5 | EXP-LB | Min | -44 | 4 | -1 | -154 | -2,420 | 14,784 |
| G05 | 0 | EXP-LB | Max | 43 | 17 | 2 | 126 | 2,105 | 72,030 |
| G05 | 138 | EXP-LB | Max | 43 | 22 | 2 | 126 | 1,908 | 70,010 |
| G05 | 0 | EXP-LB | Min | -40 | 3 | -2 | -154 | -2,420 | 14,784 |
| G05 | 138 | EXP-LB | Min | -40 | 8 | -2 | -154 | -2,173 | 14,153 |
| G06 | 0 | EXP-LB | Max | 37 | 170 | 10 | 498 | 1,908 | 70,010 |
| G06 | 73 | EXP-LB | Max | 37 | 175 | 10 | 498 | 1,066 | 52,525 |
| G06 | 0 | EXP-LB | Min | -34 | 29 | -11 | -564 | -2,173 | 14,153 |
| G06 | 73 | EXP-LB | Min | -34 | 34 | -11 | -564 | -1,123 | 10,985 |
| G07 | 0 | EXP-LB | Max | 30 | 176 | 10 | 498 | 1,066 | 52,525 |
| G07 | 146 | EXP-LB | Max | 30 | 182 | 10 | 498 | 576 | 27,790 |
| G07 | 0 | EXP-LB | Min | -28 | 32 | -11 | -564 | -1,123 | 10,985 |
| G07 | 146 | EXP-LB | Min | -28 | 38 | -11 | -564 | -465 | 6,126 |
| G08 | 0 | EXP-LB | Max | 22 | 184 | 9 | 498 | 576 | 27,790 |
| G08 | 138 | EXP-LB | Max | 22 | 190 | 9 | 498 | 1,760 | 719 |
| G08 | 0 | EXP-LB | Min | -20 | 38 | -9 | -564 | -465 | 6,126 |
| G08 | 138 | EXP-LB | Min | -20 | 44 | -9 | -564 | -1,610 | -706 |
| G09 | 0 | EXP-LB | Max | 63 | -41 | 9 | 494 | 2,458 | 493 |
| G09 | 146 | EXP-LB | Max | 63 | -35 | 9 | 494 | 1,075 | 23,790 |
| G09 | 0 | EXP-LB | Min | -61 | -168 | -10 | -448 | -2,303 | -487 |
| G09 | 146 | EXP-LB | Min | -61 | -162 | -10 | -448 | -920 | 5,457 |
| G10 | 0 | EXP-LB | Max | 54 | -36 | 11 | 494 | 1,075 | 23,790 |
| G10 | 138 | EXP-LB | Max | 54 | -30 | 11 | 494 | 527 | 45,577 |
| G10 | 0 | EXP-LB | Min | -52 | -161 | -10 | -448 | -920 | 5,457 |
| G10 | 138 | EXP-LB | Min | -52 | -155 | -10 | -448 | -530 | 10,035 |
| G11 | 0 | EXP-LB | Max | 45 | -32 | 11 | 494 | 527 | 45,577 |
| G11 | 174.5 | EXP-LB | Max | 45 | -25 | 11 | 494 | 2,134 | 71,721 |
| G11 | 0 | EXP-LB | Min | -46 | -153 | -10 | -448 | -530 | 10,035 |
| G11 | 174.5 | EXP-LB | Min | -46 | -146 | -10 | -448 | -2,432 | 14,987 |
| G12 | 0 | EXP-LB | Max | 34 | 15 | 2 | 135 | 2,134 | 71,931 |

| M.8.1 EXP-LB: Element Forces - Frames - Girders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Girder | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G12 | 36.5 | EXP-LB | Max | 34 | 17 | 2 | 135 | 2,097 | 71,375 |
| G12 | 0 | EXP-LB | Min | -38 | 3 | -2 | -147 | -2,432 | 14,834 |
| G12 | 36.5 | EXP-LB | Min | -38 | 5 | -2 | -147 | -2,394 | 14,672 |
| G13 | 0 | EXP-LB | Max | 30 | 17 | 2 | 135 | 2,097 | 71,375 |
| G13 | 138 | EXP-LB | Max | 30 | 22 | 2 | 135 | 1,909 | 69,271 |
| G13 | 0 | EXP-LB | Min | -34 | 3 | -3 | -147 | -2,394 | 14,672 |
| G13 | 138 | EXP-LB | Min | -34 | 8 | -3 | -147 | -2,165 | 13,981 |
| G14 | 0 | EXP-LB | Max | 25 | 172 | 10 | 494 | 1,909 | 69,271 |
| G14 | 73 | EXP-LB | Max | 25 | 176 | 10 | 494 | 1,057 | 51,650 |
| G14 | 0 | EXP-LB | Min | -29 | 30 | -11 | -545 | -2,165 | 13,981 |
| G14 | 73 | EXP-LB | Min | -29 | 34 | -11 | -545 | -1,115 | 10,722 |
| G15 | 0 | EXP-LB | Max | 21 | 177 | 10 | 494 | 1,057 | 51,650 |
| G15 | 146 | EXP-LB | Max | 21 | 183 | 10 | 494 | 546 | 26,827 |
| G15 | 0 | EXP-LB | Min | -22 | 33 | -11 | -545 | -1,115 | 10,722 |
| G15 | 146 | EXP-LB | Min | -22 | 38 | -11 | -545 | -440 | 5,826 |
| G16 | 0 | EXP-LB | Max | 17 | 184 | 9 | 494 | 546 | 26,827 |
| G16 | 138 | EXP-LB | Max | 17 | 190 | 9 | 494 | 1,748 | 730 |
| G16 | 0 | EXP-LB | Min | -18 | 37 | -9 | -545 | -440 | 5,826 |
| G16 | 138 | EXP-LB | Min | -18 | 43 | -9 | -545 | -1,572 | -618 |
| | | **Girder** | **Max:** | **73** | **190** | **12** | **501** | **2,459** | **72,539** |
| | | **EXP-LB** | **Min:** | **-75** | **-169** | **-11** | **-564** | **-2,460** | **-706** |
| | | | **Abs:** | **75** | **190** | **12** | **564** | **2,460** | **72,539** |

## M.8.2 EXP-LB -End Ties

| M.8.2 EXP-LB: Element Forces - Frames - End Ties | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| End Tie | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| ET1 | 0 | EXP-LB | Max | 8 | -1 | 8 | 0 | 990 | -26 |
| ET1 | 120 | EXP-LB | Max | 8 | 0 | 8 | 0 | 67 | 55 |
| ET1 | 0 | EXP-LB | Min | -8 | -2 | -9 | 0 | -1,066 | -80 |
| ET1 | 120 | EXP-LB | Min | -8 | 0 | -9 | 0 | -68 | -1 |
| ET2 | 0 | EXP-LB | Max | 7 | 0 | 9 | 0 | 67 | 55 |
| ET2 | 120 | EXP-LB | Max | 7 | 2 | 9 | 0 | 1,040 | -23 |
| ET2 | 0 | EXP-LB | Min | -7 | 0 | -9 | 0 | -68 | -1 |
| ET2 | 120 | EXP-LB | Min | -7 | 1 | -9 | 0 | -1,015 | -83 |
| ET3 | 0 | EXP-LB | Max | 10 | -1 | 15 | 0 | 1,765 | -24 |
| ET3 | 120 | EXP-LB | Max | 10 | 0 | 15 | 0 | 129 | 57 |
| ET3 | 0 | EXP-LB | Min | -12 | -2 | -14 | 0 | -1,611 | -83 |
| ET3 | 120 | EXP-LB | Min | -12 | -1 | -14 | 0 | -106 | -3 |
| ET4 | 0 | EXP-LB | Max | 9 | 1 | 15 | 0 | 129 | 57 |
| ET4 | 120 | EXP-LB | Max | 9 | 2 | 15 | 0 | 1,575 | -21 |
| ET4 | 0 | EXP-LB | Min | -11 | -1 | -13 | 0 | -106 | -3 |
| ET4 | 120 | EXP-LB | Min | -11 | 1 | -13 | 0 | -1,753 | -86 |
| | | **End Tie** | **Max:** | **10** | **2** | **15** | **0** | **1,765** | **57** |
| | | **EXP-LB** | **Min:** | **-12** | **-2** | **-14** | **0** | **-1,753** | **-86** |
| | | | **Abs:** | **12** | **2** | **15** | **0** | **1,765** | **86** |

## M.8.3 EXP-LB -Trucks

| M.8.3 EXP-LB: Element Forces - Frames - Trucks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Step | P | V2 | V3 | T | M2 | M3 |
| Trucks | in | Case | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| TK1 | 0 | EXP-LB | Max | 14 | -19 | 40 | 735 | 0 | 250 |
| TK1 | 36 | EXP-LB | Max | 14 | -17 | 40 | 735 | 1,524 | 3,050 |
| TK1 | 0 | EXP-LB | Min | -16 | -90 | -42 | -677 | 0 | -271 |
| TK1 | 36 | EXP-LB | Min | -16 | -88 | -42 | -677 | -1,424 | 693 |
| TK2 | 0 | EXP-LB | Max | 1 | 93 | 45 | 772 | 1,608 | 3,368 |
| TK2 | 36 | EXP-LB | Max | 1 | 95 | 45 | 772 | 0 | 0 |
| TK2 | 0 | EXP-LB | Min | -1 | 19 | -46 | -759 | -1,645 | 725 |
| TK2 | 36 | EXP-LB | Min | -1 | 21 | -46 | -759 | 0 | 0 |
| TK3 | 0 | EXP-LB | Max | 1 | -20 | 36 | 615 | 0 | 0 |
| TK3 | 36 | EXP-LB | Max | 1 | -18 | 36 | 615 | 1,265 | 3,088 |
| TK3 | 0 | EXP-LB | Min | -1 | -87 | -35 | -618 | 0 | 0 |
| TK3 | 36 | EXP-LB | Min | -1 | -85 | -35 | -618 | -1,297 | 668 |
| TK4 | 0 | EXP-LB | Max | 1 | 86 | 38 | 673 | 1,384 | 3,115 |
| TK4 | 36 | EXP-LB | Max | 1 | 88 | 38 | 673 | 0 | 0 |
| TK4 | 0 | EXP-LB | Min | -1 | 22 | -39 | -676 | -1,399 | 824 |
| TK4 | 36 | EXP-LB | Min | -1 | 24 | -39 | -676 | 0 | 0 |
| TK5 | 0 | EXP-LB | Max | 21 | -22 | 2 | 0 | 0 | 358 |
| TK5 | 36 | EXP-LB | Max | 21 | -20 | 2 | 0 | 49 | 3,443 |
| TK5 | 0 | EXP-LB | Min | -25 | -99 | -1 | -1 | 0 | -425 |
| TK5 | 36 | EXP-LB | Min | -25 | -97 | -1 | -1 | -62 | 726 |
| TK6 | 0 | EXP-LB | Max | 1 | 103 | 1 | 0 | 51 | 3,736 |
| TK6 | 36 | EXP-LB | Max | 1 | 105 | 1 | 0 | 0 | 0 |
| TK6 | 0 | EXP-LB | Min | -1 | 20 | -2 | 0 | -62 | 773 |
| TK6 | 36 | EXP-LB | Min | -1 | 22 | -2 | 0 | 0 | 0 |
| TK7 | 0 | EXP-LB | Max | 1 | -21 | 2 | 0 | 0 | 0 |
| TK7 | 36 | EXP-LB | Max | 1 | -19 | 2 | 0 | 52 | 3,469 |
| TK7 | 0 | EXP-LB | Min | -1 | -97 | -1 | 0 | 0 | 0 |
| TK7 | 36 | EXP-LB | Min | -1 | -95 | -1 | 0 | -62 | 718 |
| TK8 | 0 | EXP-LB | Max | 1 | 97 | 1 | 0 | 51 | 3,537 |
| TK8 | 36 | EXP-LB | Max | 1 | 99 | 1 | 0 | 0 | 0 |
| TK8 | 0 | EXP-LB | Min | -1 | 22 | -1 | 0 | -53 | 838 |
| TK8 | 36 | EXP-LB | Min | -1 | 24 | -1 | 0 | 0 | 0 |
| | | **Trucks** | **Max:** | **21** | **105** | **45** | **772** | **1,608** | **3,736** |
| | | **EXP-LB** | **Min:** | **-25** | **-99** | **-46** | **-759** | **-1,645** | **-425** |
| | | | **Abs:** | **25** | **105** | **46** | **772** | **1,645** | **3,736** |

**CAL-20776-SE-007**

**CRANE NONLINEAR SEISMIC ANALYSIS**

**ATTACHMENT N**

**SAP 2000 THEORETICAL BASIS**
**FOR**
**NON-LINEAR MODAL TIME HISTORY ANALYSIS**

The method for solution for nonlinear modal time history analyses is an extension of the Fast Nonlinear Analysis method developed by Ed Wilson (Ibrahim and Wilson, 1989; Wilson, 1993). The solution method is applicable when the nonlinearity is restricted to Link/Support elements as is the case for this analysis. For this analysis, all the crane structural members remain elastic.

The solution method first requires a Modal Analysis be performed utilizing the Ritz-Vector Analysis Method. Starting load vectors for the Ritz method include nonlinear deformation loads for each nonlinear degree of freedom. The next step is to solve the nonlinear equations of motion iteratively at each time step utilizing modal superposition. Iterations continue at each time step until the solutions converges to the convergence tolerances set by the user. The program automatically reduces the size of the time step if convergence is not achieved. Sensitivity studies were conducted ensure that convergence tolerances were appropriately set.

A description of the solution method along with the applicable equations of motion is described in Chapter XXIV of the SAP2000 Analysis Reference Manual. The applicable pages of the SAP2000 Analysis Reference Manual, Chapter XXIV, are provided in this attachment (copyright permission received).

Chapter XXIV

# Nonlinear Time-History Analysis

Time-history analysis is a step-by-step analysis of the dynamical response of a structure to a specified loading that may vary with time. The analysis may be linear or nonlinear. The Chapter describes concepts that apply only to nonlinear time-history analysis. You should first read Chapter "Linear Time-History Analysis" (page 329) which describes concepts that apply to all time-history analyses.

**Advanced Topics**

- Overview
- Nonlinearity
- Loading
- Initial Conditions
- Time Steps
- Nonlinear Modal Time-History Analysis (FNA)
- Nonlinear Direct-Integration Time-History Analysis

# Overview

Time-history analysis is used to determine the dynamic response of a structure to arbitrary loading. The dynamic equilibrium equations to be solved are given by:

$$\boldsymbol{K}\,\boldsymbol{u}(t)+\boldsymbol{C}\,\dot{\boldsymbol{u}}(t)+\boldsymbol{M}\,\ddot{\boldsymbol{u}}(t)=\boldsymbol{r}(t)$$

where $\boldsymbol{K}$ is the stiffness matrix; $\boldsymbol{C}$ is the damping matrix; $\boldsymbol{M}$ is the diagonal mass matrix; $\boldsymbol{u}$, $\dot{\boldsymbol{u}}$, and $\ddot{\boldsymbol{u}}$ are the displacements, velocities, and accelerations of the structure; and $\boldsymbol{r}$ is the applied load. If the load includes ground acceleration, the displacements, velocities, and accelerations are relative to this ground motion.

Any number of time-history Analysis Cases can be defined. Each time-history case can differ in the load applied and in the type of analysis to be performed.

There are several options that determine the type of time-history analysis to be performed:

- Linear vs. Nonlinear.
- Modal vs. Direct-integration: These are two different solution methods, each with advantages and disadvantages. Under ideal circumstances, both methods should yield the same results to a given problem.
- Transient vs. Periodic: Transient analysis considers the applied load as a one-time event, with a beginning and end. Periodic analysis considers the load to repeat indefinitely, with all transient response damped out.

In a nonlinear analysis, the stiffness, damping, and load may all depend upon the displacements, velocities, and time. This requires an iterative solution to the equations of motion.

Before reading this Chapter on nonlinear analysis, you should first read Chapter "Linear Time-History Analysis" (page 329) which describes concepts that apply to all time-history analyses

# Nonlinearity

The following types of nonlinearity are available in SAP2000:

- Material nonlinearity
  - Various type of nonlinear properties in Link/Support elements
  - Tension and/or compression limits in Frame elements

  - Plastic hinges in Frame elements
- Geometric nonlinearity
  - P-delta effects
  - Large displacement effects

For nonlinear direct-integration time-history analysis, all of the available nonlinearities may be considered.

For nonlinear modal time-history analysis, only the nonlinear behavior of the Link/Support elements is included. If the modes used for this analysis were computed using the stiffness from the end of a nonlinear analysis, all other types of nonlinearities are locked into the state that existed at the end of that nonlinear analysis.

## Loading

The application of load for nonlinear time-history analysis is identical to that used for linear time-history analysis. Please see Topic "Loading" (page 330) in Chapter "Linear Time-History Analysis" for more information.

## Initial Conditions

The initial conditions describe the state of the structure at the beginning of a time-history case. These include:

- Displacements and velocities
- Internal forces and stresses
- Internal state variables for nonlinear elements
- Energy values for the structure
- External loads

The accelerations are not considered initial conditions, but are computed from the equilibrium equation.

For nonlinear analyses, you may specify the initial conditions at the start of the analysis. You have two choices:

- Zero initial conditions: the structure has zero displacement and velocity, all elements are unstressed, and there is no history of nonlinear deformation.

- Continue from a previous nonlinear analysis: the displacements, velocities, stresses, loads, energies, and nonlinear state histories from the end of a previous analysis are carried forward.

There are some restrictions when continuing from a previous nonlinear case:

- Nonlinear static and nonlinear direct-integration time-history cases may be chained together in any combination, i.e., both types of analysis are compatible with each other.
- Nonlinear modal time-history (FNA) cases can only continue from other FNA cases that use modes from the same modal analysis case.

When continuing from a previous case, all applied loads specified for the present analysis case are incremental, i.e., they are added to the loads already acting at the end of the previous case.

When performing a nonlinear time-history analysis, such as for earthquake loading, it is often necessary to start from a nonlinear static state, such as due to gravity loading. For nonlinear direct-integration analysis, you can continue from a nonlinear static analysis case. But since FNA analyses can only continue from other FNA cases, special consideration must be given to how to model static loading using FNA. See Topic "Nonlinear Modal Time-History Analysis (FNA)" (page 121) for more information.

Note that, by contrast, linear time-history analyses *always* start from zero initial conditions.

## Time Steps

The choice of output time steps is the same for linear and nonlinear time-history analysis. Please see Topic "Time Steps" (page 334) in Chapter "Linear Time-History Analysis" for more information.

The nonlinear analysis will internally solve the equations of motion at each output time step and at each load function time step, just as for linear analysis. In addition, you may specify a maximum substep size that is smaller than the output time step in order to reduce the amount of nonlinear iteration, and also to increase the accuracy of direct-integration analysis. The program may also choose smaller substeps sizes automatically when it detects slow convergence.

# Nonlinear Modal Time-History Analysis (FNA)

The method of nonlinear time-history analysis used in SAP2000 is an extension of the Fast Nonlinear Analysis (FNA) method developed by Wilson (Ibrahimbegovic and Wilson, 1989; Wilson, 1993). The method is extremely efficient and is designed to be used for structural systems which are primarily linear elastic, but which have a limited number of predefined nonlinear elements. For the FNA method, all nonlinearity is restricted to the Link/Support elements. A short description of the method follows.

The dynamic equilibrium equations of a linear elastic structure with predefined nonlinear Link/Support elements subjected to an arbitrary load can be written as:

$$\boldsymbol{K}_L\,\boldsymbol{u}(t) + \boldsymbol{C}\,\dot{\boldsymbol{u}}(t) + \boldsymbol{M}\,\ddot{\boldsymbol{u}}(t) + \boldsymbol{r}_N(t) = \boldsymbol{r}(t)$$

where $\boldsymbol{K}_L$ is the stiffness matrix for the linear elastic elements (all elements except the Links/Supports); $\boldsymbol{C}$ is the proportional damping matrix; $\boldsymbol{M}$ is the diagonal mass matrix; $\boldsymbol{r}_N$ is the vector of forces from the nonlinear degrees of freedom in the Link/Support elements; $\boldsymbol{u}$, $\dot{\boldsymbol{u}}$, and $\ddot{\boldsymbol{u}}$ are the relative displacements, velocities, and accelerations with respect to the ground; and $\boldsymbol{r}$ is the vector of applied loads. See Topic "Loading" (page 330) in Chapter "Linear Time-History Analysis" for the definition of $\boldsymbol{r}$.

## Initial Conditions

See Topic "Initial Conditions" (page 121) in this Chapter for a general discussion of initial conditions.

Because FNA analyses can only continue from other FNA analyses, special consideration must be given to how you can model static loads that may act on the structure prior to a dynamic analysis.

It is actually very simple to perform static analysis using FNA. The load is applied quasi-statically (very slowly) with high damping. To define a quasi-static FNA analysis:

- Define a ramp-type time-history function that increases linearly from zero to one over a length of time that is long (say ten times) compared to the first period of the structure, and then holds constant for an equal length of time. Call this function "RAMPQS"
- Define a nonlinear modal time-history (FNA) case:
  - Call this case "HISTQS"

- Start from zero or another FNA case
- Apply the desired Load Case(s) using function "RAMPQS"
- Use as few or as many time steps as you wish, but make sure the total time is at least twice the ramp-up time of function "RAMPQS"
- Use high modal damping, say 0.99

You can use case "HISTQS" as the initial conditions for other FNA cases.

This approach is particularly useful for nonlinear analysis where the behavior of certain Link/Support elements, especially the Gap, Hook and Friction types, is strongly dependent on the *total* force or displacement acting on the elements.

## Link/Support Effective Stiffness

For the purposes of analysis, a linear **effective stiffness** is defined for each degree of freedom of the nonlinear elements. The effective stiffness at nonlinear degrees of freedom is arbitrary, but generally varies between zero and the maximum nonlinear stiffness of that degree of freedom.

The equilibrium equation can then be rewritten as:

$$\boldsymbol{K}\,\boldsymbol{u}(t)+\boldsymbol{C}\,\dot{\boldsymbol{u}}(t)+\boldsymbol{M}\,\ddot{\boldsymbol{u}}(t)=\boldsymbol{r}(t)-[\,\boldsymbol{r}_N(t)-\boldsymbol{K}_N\,\boldsymbol{u}(t)\,]$$

where $\boldsymbol{K}=\boldsymbol{K}_L+\boldsymbol{K}_N$, with $\boldsymbol{K}_L$ being the stiffness of all the linear elements and for the linear degrees of freedom of the Link/Support elements, and $\boldsymbol{K}_N$ being the linear effective-stiffness matrix for all of the nonlinear degrees of freedom.

See Chapter "The Link/Support Element—Basic" (page 211) for more information.

## Mode Superposition

Modal analysis is performed using the full stiffness matrix, $\boldsymbol{K}$, and the mass matrix, $\boldsymbol{M}$. It is *strongly recommended* that the Ritz-vector method be used to perform the modal analysis.

Using standard techniques, the equilibrium equation can be written in modal form as:

$$\Omega^2\,\boldsymbol{a}(t)+\Lambda\,\dot{\boldsymbol{a}}(t)+\boldsymbol{I}\,\ddot{\boldsymbol{a}}(t)=\boldsymbol{q}(t)-\boldsymbol{q}_N(t)$$

where $\Omega^2$ is the diagonal matrix of squared structural frequencies given by:

$$\Omega^2 = \Phi^T K \Phi$$

$\Lambda$ is the modal damping matrix which is assumed to be diagonal:

$$\Lambda = \Phi^T C \Phi$$

$I$ is the identity matrix which satisfies:

$$I = \Phi^T M \Phi$$

$q(t)$ is the vector of modal applied loads:

$$q(t) = \Phi^T r(t)$$

$q_N(t)$ is the vector of modal forces from the nonlinear elements:

$$q_N(t) = \Phi^T [r_N(t) - K_N u(t)]$$

$a(t)$ is the vector of modal displacement amplitudes such that:

$$u(t) = \Phi a(t)$$

and $\Phi$ is the matrix of mode shapes.

It should be noted that, unlike linear dynamic analysis, the above modal equations are coupled. In general the nonlinear forces, $q_N(t)$, will couple the modes since they are functions of the modal displacements, $a(t)$.

It is important to recognize that the solution to these modal equations is dependent on being able to adequately represent the nonlinear forces by the modal forces, $q_N(t)$. This is not automatic, but requires the following special considerations:

- Mass and/or mass moments of inertia should be present at all nonlinear degrees of freedom.
- The Ritz-vector method should be used to determine the Modes, unless *all* possible structural Modes are found using eigenvector analysis
- The Ritz starting load vectors should include a nonlinear deformation load for each independent nonlinear degree of freedom
- A sufficient number of Ritz-vectors should be sought to capture the deformation in the nonlinear elements completely

For more information:

- See Topic "Ritz-Vector Analysis" (page 295) in Chapter "Modal Analysis".

- See Chapter "The Link/Support Element—Basic" (page 211).

## Modal Damping

As for linear modal time-history analysis, the damping in the structure is modeled using uncoupled modal damping. Each mode has a damping ratio, **damp**, which is measured as a fraction of critical damping and must satisfy:

$$0 \leq \mathbf{damp} < 1$$

Modal damping has two different sources, which are described in the following. Damping from these sources is added together. The program automatically makes sure that the total is less than one.

***Important note:*** For linear modal time-history analysis, the linear effective damping for the Link/Support elements is also used. However, it is not used for nonlinear modal time-history analysis.

### Modal Damping from the Analysis Case

For each nonlinear modal time-history Analysis Case, you may specify modal damping ratios that are:

- Constant for all modes
- Linearly interpolated by period or frequency. You specify the damping ratio at a series of frequency or period points. Between specified points the damping is linearly interpolated. Outside the specified range, the damping ratio is constant at the value given for the closest specified point.
- Mass and stiffness proportional. This mimics the proportional damping used for direct-integration, except that the damping value is never allowed to exceed unity.

In addition, you may optionally specify damping overrides. These are specific values of damping to be used for specific modes that replace the damping obtained by one of the methods above. The use of damping overrides is rarely necessary.

It is also important to note that the assumption of modal damping is being made with respect to the total stiffness matrix, $\boldsymbol{K}$, which includes the effective stiffness from the nonlinear elements. If non-zero modal damping is to be used, then the effective stiffness specified for these elements is important. The effective stiffness should be selected such that the modes for which these damping values are specified are realistic.

In general it is recommended that either the initial stiffness of the element be used as the effective stiffness or the secant stiffness obtained from tests at the expected value of the maximum displacement be used. Initially-open gap and hook elements and all damper elements should generally be specified with zero effective stiffness.

### Composite Modal Damping from the Materials

Modal damping ratios, if any, that have been specified for the Materials are converted automatically to composite modal damping. Any cross coupling between the modes is ignored. These modal-damping values will generally be different for each mode, depending upon how much deformation each mode causes in the elements composed of the different Materials.

## Iterative Solution

The nonlinear modal equations are solved iteratively in each time step. The program assumes that the right-hand sides of the equations vary linearly during a time step, and uses exact, closed-form integration to solve these equations in each iteration. The iterations are carried out until the solution converges. If convergence cannot be achieved, the program divides the time step into smaller substeps and tries again.

Several parameters are available for you to control the iteration process. In general, the use of the default values is recommended since this will solve most problems. If convergence cannot be achieved, inaccurate results are obtained, or the solution takes too long, changing these control parameters may help. However, you should first check that reasonable loads and properties have been specified, and that appropriate Modes have been obtained, preferably using the Ritz vector method.

The parameters that are available to control iteration and substepping are:

- The relative force convergence tolerance, **ftol**
- The relative energy convergence tolerance, **etol**
- The maximum allowed substep size, **dtmax**
- The minimum allowed substep size, **dtmin**
- The maximum number of force iterations permitted for small substeps, **itmax**
- The maximum number of force iterations permitted for large substeps, **itmin**
- The convergence factor, **cf**

These parameters are used in the iteration and substepping algorithm as described in the following.

### Force Convergence Check

Each time step of length **dt** is divided into substeps as needed to achieve convergence. In each substep, the solution is iterated until the change in the right-hand side of the modal equations, expressed as a fraction of the right-hand side, becomes less than the force tolerance, **ftol**. If this does not occur within the permitted number of iterations, the substep size is halved and the iteration is tried again.

The default value for **ftol** is $10^{-5}$. It must satisfy **ftol** > 0.

### Energy Convergence Check

If force convergence occurs within the permitted number of iterations, the work done by the nonlinear forces is compared with the work done by all the other force terms in the modal equilibrium equations. If the difference, expressed as a fraction of the total work done, is greater than the energy tolerance, **etol**, the substep size is halved and the iteration is tried again.

This energy check essentially measures how close to linear is the variation of the nonlinear force over the time step. It is particularly useful for detecting sudden changes in nonlinear behavior, such as the opening and closing of gaps or the onset of yielding and slipping. Setting **etol** greater than unity turns off this energy check.

The default value for **etol** is $10^{-5}$. It must satisfy **etol** > 0.

### Maximum and Minimum Substep Sizes

If the substep meets both the force and energy convergence criteria, the results of the substep are accepted, and the next substep is attempted using twice the previous substep length. The substep size is never increased beyond **dtmax**.

When the substep size is halved because of failure to meet either the force or energy convergence criteria, the resulting substep size will never be set less than **dtmin**. If the failed substep size is already **dtmin**, the results for the remaining time steps in the current History are set to zero and a warning message is issued.

The default value for **dtmax** is **dt**. The default value for **dtmin** is **dtmax**·$10^{-9}$. They must satisfy 0 < **dtmin** ≤ **dtmax** ≤ **dt**.

### Maximum Number of Iterations

The maximum number of iterations permitted for force iteration varies between **itmin** and **itmax**. The actual number permitted for a given substep is chosen auto-

matically by the program to achieve a balance between iteration and substepping. The number of iterations permitted tends to be larger for smaller substeps.

The default values for **itmin** and **itmax** are 2 and 100, respectively. They must satisfy 2 ≤ **itmin** ≤ **itmax**.

### Convergence Factor

Under-relaxation of the force iteration may be used by setting the convergence factor, **cf**, to a value less than unity. Smaller values increase the stability of the iteration, but require more iterations to achieve convergence. This is generally only needed when Damper-type elements are present with nonlinear damping exponents. Specifying **cf** to be greater than unity may reduce the number of iterations required for certain types of problems, but may cause instability in the iteration and is not recommended.

The default value for **cf** is 1. It must satisfy **cf** > 0.

## Static Period

Normally all modes are treated as being dynamic. In each time step, the response of a dynamic mode has two parts:

- Forced response, which is directly proportional to the modal load
- Transient response, which is oscillatory, and which depends on the displacements and velocities of the structure at the beginning of the time step

You may optionally specify that high-frequency (short period) modes be treated as static, so that they follow the load without any transient response. This is done by specifying a static period, **tstat**, such that all modes with periods less than **tstat** are considered to be static modes. The default for **tstat** is zero, meaning that all modes are considered to be dynamic.

Although **tstat** can be used for any nonlinear time-history analysis, it is of most use for quasi-static analyses. If the default iteration parameters do not work for such an analysis, you may try using the following parameters as a starting point:

- **tstat** greater than the longest period of the structure
- **itmax** = **itmin** ≥ 1000
- **dtmax** = **dtmin** = **dt**
- **ftol** ≤ $10^{-6}$

- **cf** = 0.1

This causes all modes to be treated as static, and uses iteration rather than substepping to find a solution. The choice of parameters to achieve convergence is very problem dependent, and you should experiment to find the best values to use for each different model.

# Nonlinear Direct-Integration Time-History Analysis

Direct integration of the full equations of motion without the use of modal superposition is available in SAP2000. While modal superposition is usually more accurate and efficient, direct-integration does offer the following advantages:

- Full damping that couples the modes can be considered
- Impact and wave propagation problems that might excite a large number of modes may be more efficiently solved by direct integration
- All types of nonlinearity available in SAP2000 may be included in a nonlinear direct integration analysis.

Direct integration results are extremely sensitive to time-step size in a way that is not true for modal superposition. You should always run your direct-integration analyses with decreasing time-step sizes until the step size is small enough that results are no longer affected by it.

## Time Integration Parameters

See Topic "Linear Direct-Integration Time-History Analysis" (page 121) for information about time-integration parameters. The same considerations apply here as for linear analysis.

If your nonlinear analysis is having trouble converging, you may want to use the HHT method with **alpha** = -1/3 to get an initial solution, then re-run the analysis with decreasing time step sizes and **alpha** values to get more accurate results.

## Nonlinearity

All material nonlinearity that has been defined in the model will be considered in a nonlinear direct-integration time-history analysis.

You have a choice of the type of geometric nonlinearity to be considered:

- None
- P-delta effects
- Large displacement effects

If you are continuing from a previous nonlinear analysis, it is strongly recommended that you select the same geometric nonlinearity parameters for the current case as for the previous case. See Chapter "Geometric Nonlinearity" (page 341) for more information.

## Initial Conditions

See Topic "Initial Conditions" (page 121) in this Chapter for a general discussion of initial conditions.

You may continue a nonlinear direct-integration time-history analysis from a nonlinear static analysis or another direct-integration time-history nonlinear analysis. It is strongly recommended that you select the same geometric nonlinearity parameters for the current case as for the previous case.

## Damping

In direct-integration time-history analysis, the damping in the structure is modeled using a full damping matrix. Unlike modal damping, this allows coupling between the modes to be considered.

Direct-integration damping has two different sources, which are described in the following. Damping from these sources is added together.

***Important note:*** For linear direct-integration time-history analysis, the linear effective damping for the nonlinear Link/Support elements is also used. However, it is not used for nonlinear direct-integration time-history analysis.

### Proportional Damping from the Analysis Case

For each direct-integration time-history Analysis Case, you may specify proportional damping coefficients that apply to the structure as a whole. The damping matrix is calculated as a linear combination of the stiffness matrix scaled by a coefficient that you specify, and the mass matrix scaled by a second coefficient that you specify.

You may specify these two coefficients directly, or they may be computed by specifying equivalent fractions of critical modal damping at two different periods or frequencies.

Stiffness proportional damping is linearly proportional to frequency. It is related to the deformations within the structure. Stiffness proportional damping may excessively damp out high-frequency components.

Stiffness-proportional damping uses the current, tangent stiffness of the structure at each time step. Thus a yielding element will have less damping than one which is elastic. Likewise, a gap element will only have stiffness-proportional damping when the gap is closed.

Mass proportional damping is linearly proportional to period. It is related to the motion of the structure, as if the structure is moving through a viscous fluid. Mass proportional damping may excessively damp out long period components.

#### Proportional Damping from the Materials

You may specify stiffness and mass proportional damping coefficients for individual materials. For example, you may want to use larger coefficients for soil materials than for steel or concrete. The same interpretation of these coefficients applies as described above for the Analysis Case damping.

## Iterative Solution

The nonlinear equations are solved iteratively in each time step. This may require re-forming and re-solving the stiffness and damping matrices. The iterations are carried out until the solution converges.

For each iteration, a line search is used to determine the optimum displacement increment to apply. Constant-stiffness iteration is tried first, followed by Newton-Raphson iteration if that fails. If convergence still cannot be achieved, the program divides the time step into a smaller substep and tries again. *The use of the line-search algorithm is a new feature, and may cause slight changes in analysis results compared to previous versions.*

Several parameters are available for you to control the iteration and substepping process. These are described in the following.

### Maximum Substep Size

The analysis will always stop at every output time step, and at every time step where one of the input time-history functions is defined. You may, in addition, set an upper limit on the step size used for integration. For example, suppose your output time step size was 0.005, and your input functions were also defined at 0.005 seconds. If you set the Maximum Substep Size to 0.001, the program will internally take five integration substeps for every saved output time step. The program may automatically use even smaller substeps if necessary to achieve convergence when iterating.

The accuracy of direct-integration methods is very sensitive to integration time step, especially for stiff (high-frequency) response. You should try decreasing the maximum substep size until you get consistent results. You can keep your output time step size fixed to prevent storing excessive amounts of data.

### Minimum Substep Size

When the nonlinear iteration cannot converge within the specified maximum number of iterations, the program automatically reduces the current step size and tries again. You can limit the smallest substep size the program will use. If the program tries to reduce the step size below this limit, it will stop the analysis and indicate that convergence had failed.

### Maximum Iterations Per Step

Iteration is used to make sure that equilibrium is achieved at each step of the analysis. You can control the number of iterations allowed in a step before the program tries using a smaller substep. The default value of 10 works well in many situations, although values of 25 to 100 are recommended for cable structures.

### Iteration Convergence Tolerance

Iteration is used to make sure that equilibrium is achieved at each step of the analysis. You can set the relative convergence tolerance that is used to compare the magnitude of force error with the magnitude of the force acting on the structure.

You may need to use significantly smaller values of convergence tolerance to get good results for large-displacements problems than for other types of nonlinearity. Try decreasing values until you get consistent results.

**CAL-20776-SE-007**

**CRANE NONLINEAR SEISMIC ANALYSIS**

**ATTACHMENT O**

**SAP 2000 THEORETICAL BASIS FOR LINK/SUPPORT ELEMENTS**

Modeling the nonlinear behavior of the drive wheels within SAP 2000 is accomplished using the SAP 2000 Link/Support Element. The SAP 2000 Reference Manual provides a description of the various types of Link/Support elements that are available to the user. The applicable Chapters of the SAP 2000 Reference Manual, Chapters XIV and XV, are provided (copyright permission received). The following paragraphs provide a general description on the Link/Support element followed by a more detailed discussion of the actual element type used to model the nonlinear behavior of the bridge girder and trolley drive wheels when subject to the Design Basis Earthquake event.

**General Description – SAP 2000 Link/Support Element**

In SAP 2000 the Support Element is used to connect a single node to the ground and the Link Element is used to connect a pair of nodes. For this analysis the Link Element was used to model the nonlinear behavior of both the bridge girder drive wheels and the trolley drive wheels. For this analysis "ground" is boundary conditions specified at the bridge girder wheels. The Support Element could have been used to model the bridge girder drive wheels but due to an error in the software the Element did not correctly recover joint base support reaction forces and therefore the Link Element was used. It was confirmed that the Link Element does not contain the Support Element error. Note that this attachment uses the term Link/Support Element even though only the Link was used for this analysis. The term Link/Support Element is used to be consistent with the terminology used in the SAP 2000 Analysis Reference Manual. The SAP 2000 Reference manual states:

"Both element types use the same types of properties. Each Link or Support Element may exhibit up to three different types of behavior: linear, nonlinear and frequency-dependent, according to the types of properties assigned to that element and the type of analysis being performed."

For this analysis both the linear and nonlinear properties of the Link/Support Element are being used for the bridge/trolley drive wheels. Linear properties are used for all degrees of freedom except for the rolling direction degree of freedom for the bridge and trolley drive wheels. The linear properties are used to enforce the vertical and transverse boundary condition given in Table 4154.3-1 of ASME NOG-1-2004. Nonlinear properties are used to model the hysteretic behavior of the drive wheels under a seismic event.

SAP 2000 follows the standard nomenclature of I-node and J-node when defining element connectivity. The Link Element contains both an I-node and a J-node which can share the same joint coordinates resulting in a zero length element. The trolley drive wheel interface with the trolley rail utilizes a zero length Link Element. The Support Element contains only a single joint connected to ground. The bridge girder drive wheels are modeled using the Support Link.

Each Link/Support Element has its own local coordinate system. Element properties and element outputs are in terms of the element local coordinate system. The SAP 2000 Reference Manual states:

"Each Link/Support Element has its own element local coordinate system used to define force-deformation properties and output. The axes of the local system are denoted 1, 2 and 3. The first axis is directed along the length of the element and corresponds to extensional deformation. The remaining two axes lie in the plane perpendicular to the element and have an orientation that you specify; these directions correspond to shear deformation."

For this analysis the local 1 axis is defined parallel to the Global +Z direction (upward). Local 2 is directed in a horizontal plane parallel to Global +X. Local 3 is in a horizontal plane defined by the right hand rule. The Support properties that represent the nonlinear behavior for the bridge drive wheels are assigned to the local 3

direction which is parallel to Global Y. The Link Element has its nonlinear properties assigned to the Local 2 direction which is parallel to Global X.

Figure 1 shows the relationship between the Global axis and Support/Link element local axis for this analysis.

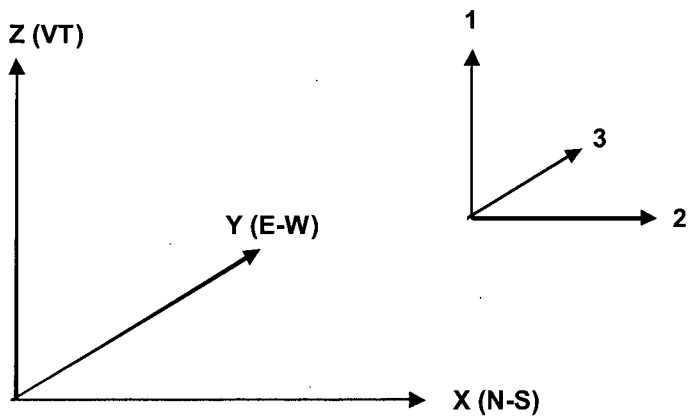


**Figure 1: Relationship Between Global Axis and Local Support/Link Axis**

**Detailed Description – SAP 2000 Link/Support Element Used for Nonlinear Analysis**

The nonlinear properties of the SAP 2000 Link/Support Element that are being used for this analysis are described next. Only the nonlinear shear degree of freedom was utilized for this analysis. All other degrees on freedom for the Link/Support Elements are linear properties which were used to enforce the boundary condition prescribed in ASME NOG. The SAP 2000 Reference Manual states:

"Each nonlinear force-deformation relationship includes a stiffness coefficient, **k**. This represents the linear stiffness when the nonlinear effect is negligible...."

For this analysis, the stiffness coefficient, **k**, represents the stiffness of the drive wheels prior to rolling.

For each nonlinear degree of freedom, a **linear effective stiffness, ke,** is also specified. This stiffness property is not used directly for nonlinear degrees of freedom. The SAP 2000 Reference Manual states:

"The effective stiffness properties are not used for nonlinear degrees of freedom during nonlinear time-history analysis. However, nonlinear modal time-history analyses do make use of the vibration modes that are computed based on the effective stiffness if the modal analysis itself start from zero initial conditions. During time integration the behavior of these modes is modified so that the structural response reflects the actual stiffness and other nonlinear parameters specified. The rate of convergence of the nonlinear iteration may be improved by changing the effective stiffness."

When a relatively large value of **k** is used, as is the case in this analysis, the SAP 2000 Analysis Reference Manual recommends:

"If you have chosen an artificially large value for **k**, be sure to use a much smaller value for **ke**, to help avoid numerical problems in nonlinear modal time-history analysis."

The specific Link/Support Element property that is being used in this analysis is the **Wen Plasticity Property**. The SAP 2000 Reference Manual states:

"For each deformational degree of freedom you may specify independent uniaxial-plasticity properties. The plasticity model is based on the hysteretic behavior proposed by Wen (1976).

All internal deformations are independent. The yielding at one degree of freedom does not affect the behavior of the other deformations. "

A more detailed description of **Wen Plasticity Property** contained in the SAP 2000 Reference Manual which is included. The SAP 2000 Reference Manual presents the equations used to describe the force-deformation relationship and several plots which define the various parameters. For this analysis the **Yield** term represents the constant rolling resistance of the bridge girder or trolley brake system. The term **Ratio** represents the post yield stiffness. **Ratio** is the post-yield stiffness and **exp** is an exponential variable that defines the transition curve from elastic to plastic behavior. For this analysis **Ratio** was set to zero and **exp** was set to the practical upper limit of 20 in order to model the drive wheel rolling which is basically an elasto-plastic behavior. **K** represents the initial stiffness of the drive wheel prior to rolling. This value of stiffness is essentially infinity until the **Yield** force is reached. Its value has been reduced in order to avoid numerical stability problems during the nonlinear time-history solution process. As shown in Figure 2, the **Wen Plasticity Property** enforces hysteretic behavior to occur in the Support/Link Element. Loading will be along the initial stiffness path **K** until **Yield** is reached, remaining at this constant resisting force until unloading occurs along the path defined by **K** in the opposite direction.

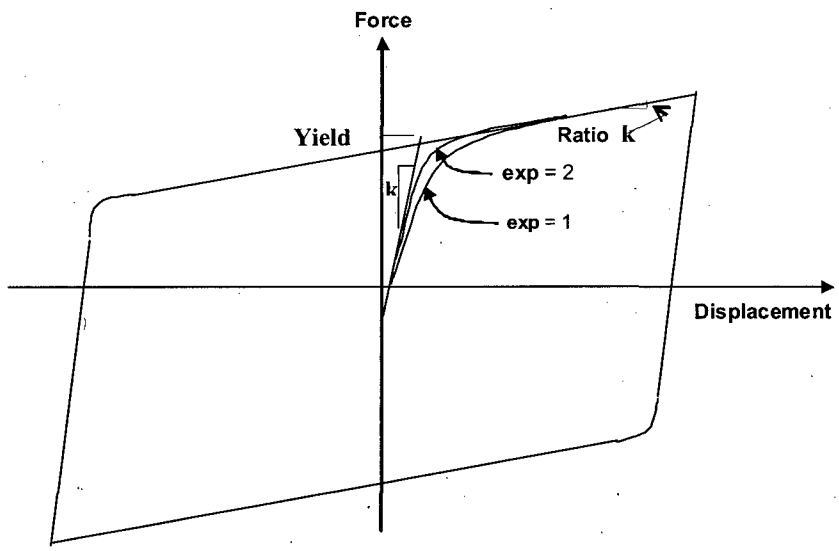


**Figure 2 Wen Plasticity Property for Uniaxial Deformation**

Chapter XIV

# The Link/Support Element—Basic

The **Link** element is used to connect two joints together. The Support element is used to connect one joint to ground. Both element types use the same types of properties. Each Link or Support element may exhibit up to three different types of behavior: linear, nonlinear, and frequency-dependent, according to the types of properties assigned to that element and the type of analysis being performed.

This Chapter describes the basic and general features of the Link and Support elements and their linear behavior. The next Chapter describes advanced behavior, which can be nonlinear or frequency-dependent.

**Advanced Topics**

- Overview
- Joint Connectivity
- Zero-Length Elements
- Degrees of Freedom
- Local Coordinate System
- Advanced Local Coordinate System
- Internal Deformations
- Link/Support Properties

- Coupled Linear Property
- Mass
- Self-Weight Load
- Gravity Load
- Internal Force and Deformation Output

## Overview

A Link element is a two-joint connecting link. A Support element is a one-joint grounded spring. Properties for both types of element are defined in the same way. Each element is assumed to be composed of six separate "springs," one for each of six deformational degrees-of freedom (axial, shear, torsion, and pure bending).

There are two categories of Link/Support properties that can be defined: Linear/Nonlinear, and Frequency-Dependent. A Linear/Nonlinear property set must be assigned to each Link or Support element. The assignment of a Frequency-Dependent property set to a Link or Support element is optional.

All Linear/Nonlinear property sets contain linear properties that are used by the element for linear analyses, and for other types of analyses if no other properties are defined. Linear/Nonlinear property sets may have nonlinear properties that will be used for all nonlinear analyses, and for linear analyses that continue from nonlinear analyses.

Frequency-dependent property sets contain impedance (stiffness and damping) properties that will be used for all frequency-dependent analyses. If a Frequency-Dependent property has not been assigned to a Link/Support element, the linear properties for that element will be used for frequency-dependent analyses.

The types of nonlinear behavior that can be modeled with this element include:

- Viscoelastic damping
- Gap (compression only) and hook (tension only)
- Multi-linear uniaxial elasticity
- Uniaxial plasticity (Wen model)
- Multi-linear uniaxial plasticity with several types of hysteretic behavior: kinematic, Takeda, and pivot
- Biaxial-plasticity base isolator

- Friction-pendulum base isolator, with or without uplift prevention. This can also be used for modeling gap-friction contact behavior

Each element has its own local coordinate system for defining the force-deformation properties and for interpreting output.

Each Link/Support element may be loaded by gravity (in any direction).

Available output includes the deformation across the element, and the internal forces at the joints of the element.

## Joint Connectivity

Each Link/Support element may take one of the following two configurations:

- A Link connecting two joints, **I** and **j**; it is permissible for the two joints to share the same location in space creating a zero-length element
- A Support connecting a single joint, **j**, to ground

## Zero-Length Elements

The following types of Link/Support elements are considered to be of zero **length**:

- Single-joint Support elements
- Two-joint Link elements with the distance from joint **I** to joint **j** being less than or equal to the zero-length tolerance that you specify.

The length tolerance is set using the Auto Merge Tolerance in the graphical user interface. Two-joint elements having a length greater than the Auto Merge Tolerance are considered to be of finite length. Whether an element is of zero length or finite length affects the definition of the element local coordinate system, and the internal moments due to shear forces.

## Degrees of Freedom

The Link/Support element always activates all six degrees of freedom at each of its one or two connected joints. To which joint degrees of freedom the element contributes stiffness depends upon the properties you assign to the element. You must ensure that restraints or other supports are provided to those joint degrees of freedom that receive no stiffness.

For more information:

- See Topic "Degrees of Freedom" (page 30) in Chapter "Joints and Degrees of Freedom."
- See Topic "Link/Support Properties" (page 222) in this Chapter.

# Local Coordinate System

Each Link/Support element has its own **element local coordinate system** used to define force-deformation properties and output. The axes of this local system are denoted 1, 2 and 3. The first axis is directed along the length of the element and corresponds to extensional deformation. The remaining two axes lie in the plane perpendicular to the element and have an orientation that you specify; these directions correspond to shear deformation.

It is important that you clearly understand the definition of the element local 1-2-3 coordinate system and its relationship to the global X-Y-Z coordinate system. Both systems are right-handed coordinate systems. It is up to you to define local systems which simplify data input and interpretation of results.

In most structures the definition of the element local coordinate system is extremely simple. The methods provided, however, provide sufficient power and flexibility to describe the orientation of Link/Support elements in the most complicated situations.

The simplest method, using the **default orientation** and the **Link/Support element coordinate angle**, is described in this topic. Additional methods for defining the Link/Support element local coordinate system are described in the next topic.

For more information:

- See Chapter "Coordinate Systems" (page 11) for a description of the concepts and terminology used in this topic.
- See Topic "Advanced Local Coordinate System" (page 216) in this Chapter.

## Longitudinal Axis 1

Local axis 1 is the longitudinal axis of the element, corresponding to extensional deformation. This axis is determined as follows:

- For elements of finite length this axis is automatically defined as the direction from joint **I** to joint **j**

- For zero-length elements the local 1 axis defaults to the +Z global coordinate direction (upward)

For the definition of zero-length elements, see Topic "Zero-Length Elements" (page 213) in this Chapter.

## Default Orientation

The default orientation of the local 2 and 3 axes is determined by the relationship between the local 1 axis and the global Z axis. The procedure used here is identical to that for the Frame element:

- The local 1-2 plane is taken to be vertical, i.e., parallel to the Z axis
- The local 2 axis is taken to have an upward (+Z) sense unless the element is vertical, in which case the local 2 axis is taken to be horizontal along the global +X direction
- The local 3 axis is always horizontal, i.e., it lies in the X-Y plane

An element is considered to be vertical if the sine of the angle between the local 1 axis and the Z axis is less than $10^{-3}$.

The local 2 axis makes the same angle with the vertical axis as the local 1 axis makes with the horizontal plane. This means that the local 2 axis points vertically upward for horizontal elements.

## Coordinate Angle

The Link/Support element coordinate angle, **ang**, is used to define element orientations that are different from the default orientation. It is the angle through which the local 2 and 3 axes are rotated about the positive local 1 axis from the default orientation. The rotation for a positive value of **ang** appears counterclockwise when the local +1 axis is pointing toward you. The procedure used here is identical to that for the Frame element.

For vertical elements, **ang** is the angle between the local 2 axis and the horizontal +X axis. Otherwise, **ang** is the angle between the local 2 axis and the vertical plane containing the local 1 axis. See Figure 48 (page 216) for examples.

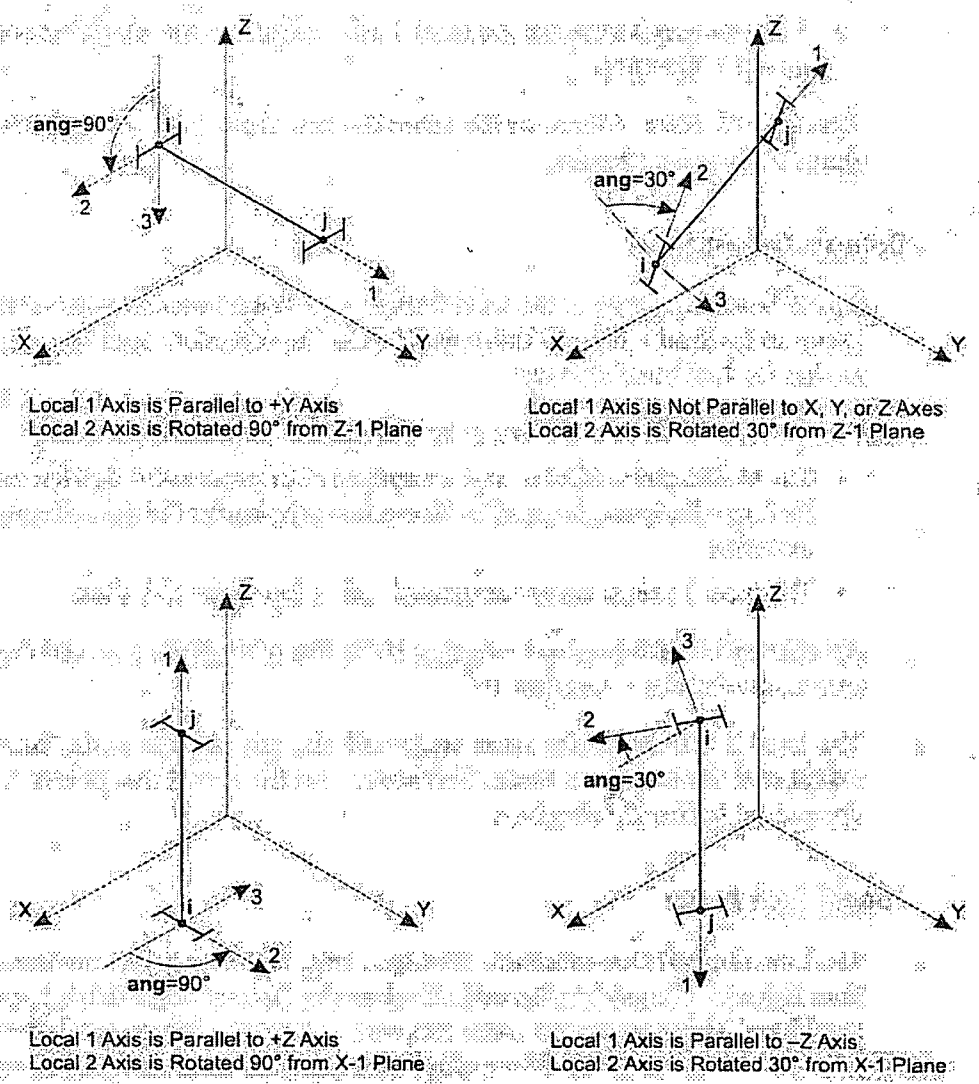


**Figure 48**

*The Link/Support Element Coordinate Angle with Respect to the Default Orientation*

# Advanced Local Coordinate System

By default, the element local coordinate system is defined using the element coordinate angle measured with respect to the global +Z and +X directions, as described

in the previous topic. In certain modeling situations it may be useful to have more control over the specification of the local coordinate system.

This topic describes how to define the orientation of the transverse local 2 and 3 axes with respect to an arbitrary reference vector when the element coordinate angle, **ang**, is zero. If **ang** is different from zero, it is the angle through which the local 2 and 3 axes are rotated about the positive local 1 axis from the orientation determined by the reference vector.

This topic also describes how to change the orientation of the local 1 axis from the default global +Z direction for zero-length elements. The local 1 axis is *always* directed from joint **I** to joint **j** for elements of *finite length*.

For more information:

- See Chapter "Coordinate Systems" (page 11) for a description of the concepts and terminology used in this topic.
- See Topic "Local Coordinate System" (page 213) in this Chapter.

## Axis Reference Vector

To define the local 1 axis for *zero-length* elements, you specify an **axis reference vector** that is parallel to and has the same positive sense as the desired local 1 axis. The axis reference vector has no effect upon finite-length elements.

To define the axis reference vector, you must first specify or use the default values for:

- A coordinate direction **axdir** (the default is +Z)
- A fixed coordinate system **csys** (the default is zero, indicating the global coordinate system). This will be the same coordinate system that is used to define the plane reference vector, as described below

You may optionally specify:

- A pair of joints, **axveca** and **axvecb** (the default for each is zero, indicating the center of the element). If both are zero, this option is not used

For each element, the axis reference vector is determined as follows:

1. A vector is found from joint **axveca** to joint **axvecb**. If this vector is of finite length, it is used as the reference vector $\mathbf{V}_a$

2. Otherwise, the coordinate direction **axdir** is evaluated at the center of the element in fixed coordinate system **csys**, and is used as the reference vector $\mathbf{V}_a$.

The center of a zero-length element is taken to be at joint **j**.

The local 1 axis is given by the vector $\mathbf{V}_a$ after it has been normalized to unit length.

## Plane Reference Vector

To define the transverse local axes 2 and 3, you specify a **plane reference vector** that is parallel to the desired 1-2 or 1-3 plane. The procedure used here is identical to that for the Frame element.

The reference vector must have a positive projection upon the corresponding transverse local axis (2 or 3, respectively). This means that the positive direction of the reference vector must make an angle of less than 90° with the positive direction of the desired transverse axis.

To define the reference vector, you must first specify or use the default values for:

- A primary coordinate direction **pldirp** (the default is +Z)
- A secondary coordinate direction **pldirs** (the default is +X). Directions **pldirs** and **pldirp** should not be parallel to each other unless you are sure that they are not parallel to local axis 1
- A fixed coordinate system **csys** (the default is zero, indicating the global coordinate system). This will be the same coordinate system that was used to define the axis reference vector, as described above
- The local plane, **local**, to be determined by the reference vector (the default is 12, indicating plane 1-2)

You may optionally specify:

- A pair of joints, **plveca** and **plvecb** (the default for each is zero, indicating the center of the element). If both are zero, this option is not used

For each element, the reference vector is determined as follows:

1. A vector is found from joint **plveca** to joint **plvecb**. If this vector is of finite length and is not parallel to local axis 1, it is used as the reference vector $V_p$.
2. Otherwise, the primary coordinate direction **pldirp** is evaluated at the center of the element in fixed coordinate system **csys**. If this direction is not parallel to local axis 1, it is used as the reference vector $V_p$.

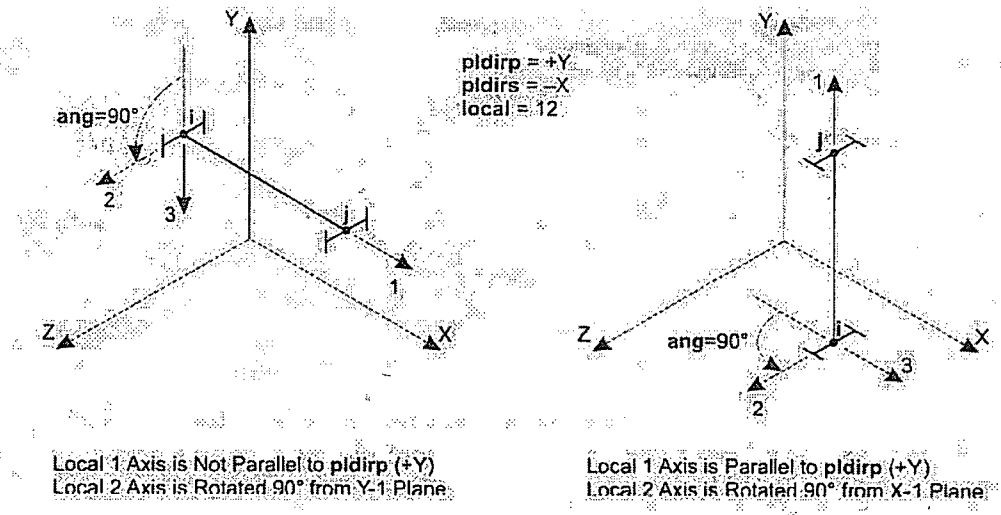


**Figure 49**
*The Link/Support Element Coordinate Angle with Respect to Coordinate Directions*

3. Otherwise, the secondary coordinate direction **pldirs** is evaluated at the center of the element in fixed coordinate system **csys**. If this direction is not parallel to local axis 1, it is used as the reference vector $V_p$.

4. Otherwise, the method fails and the analysis terminates. This will never happen if **pldirp** is not parallel to **pldirs**.

A vector is considered to be parallel to local axis 1 if the sine of the angle between them is less than $10^{-3}$.

The use of the Link/Support element coordinate angle in conjunction with coordinate directions that define the reference vector is illustrated in Figure 49 (page 219). The use of joints to define the reference vector is shown in Figure 50 (page 220).

## Determining Transverse Axes 2 and 3

The program uses vector cross products to determine the transverse axes 2 and 3 once the reference vector has been specified. The three axes are represented by the three unit vectors $\mathbf{V}_1$, $\mathbf{V}_2$ and $\mathbf{V}_3$, respectively. The vectors satisfy the cross-product relationship:

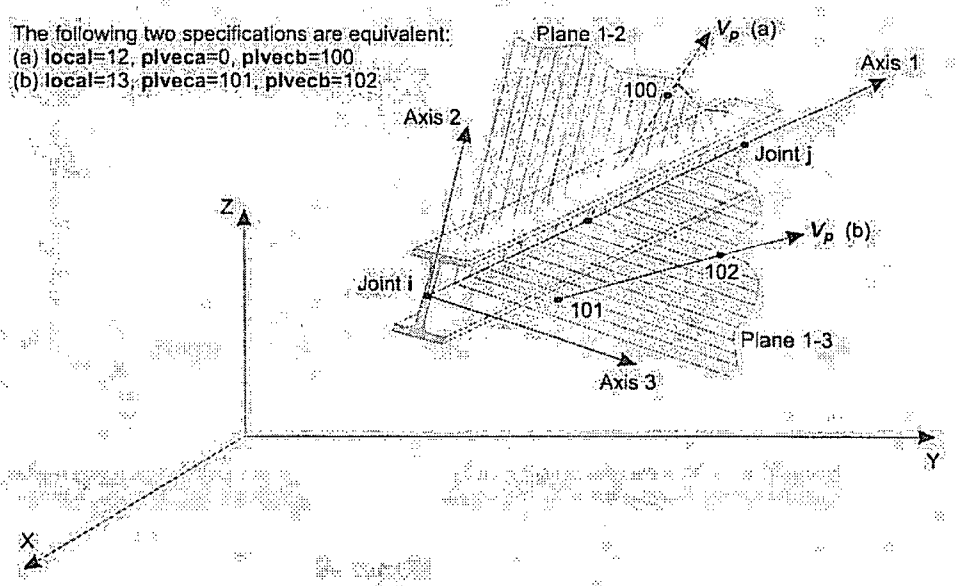


**Figure 50**
*Using Joints to Define the Link/Support Element Local Coordinate System*

$$\mathbf{V}_1 = \mathbf{V}_2 \times \mathbf{V}_3$$

The transverse axes 2 and 3 are defined as follows:

- If the reference vector is parallel to the 1-2 plane, then:

$$\mathbf{V}_3 = \mathbf{V}_1 \times \mathbf{V}_p \quad \text{and}$$
$$\mathbf{V}_2 = \mathbf{V}_3 \times \mathbf{V}_1$$

- If the reference vector is parallel to the 1-3 plane, then:

$$\mathbf{V}_2 = \mathbf{V}_p \times \mathbf{V}_1 \quad \text{and}$$
$$\mathbf{V}_3 = \mathbf{V}_1 \times \mathbf{V}_2$$

In the common case where the reference vector is perpendicular to axis $\mathbf{V}_1$, the transverse axis in the selected plane will be equal to $V_p$.

# Internal Deformations

Six independent **internal deformations** are defined for the Link/Support element. These are calculated from the relative displacements of joint **j** with respect to:

- Joint **i** for a two-joint element
- The ground for a single-joint element

For *two-joint Link/Support* elements the internal deformations are defined as:

- Axial: $d_{u1} = u_{1j} - u_{1i}$
- Shear in the 1-2 plane: $d_{u2} = u_{2j} - u_{2i} - \mathbf{dj2}\, r_{3j} - (L - \mathbf{dj2})\, r_{3i}$
- Shear in the 1-3 plane: $d_{u3} = u_{3j} - u_{3i} + \mathbf{dj3}\, r_{2j} + (L - \mathbf{dj3})\, r_{2i}$
- Torsion: $d_{r1} = r_{1j} - r_{1i}$
- Pure bending in the 1-3 plane: $d_{r2} = r_{2i} - r_{2j}$
- Pure bending in the 1-2 plane: $d_{r3} = r_{3j} - r_{3i}$

where:

- $u_{1i}$, $u_{2i}$, $u_{3i}$, $r_{1i}$, $r_{2i}$, and $r_{3i}$ are the translations and rotations at joint **i**
- $u_{1j}$, $u_{2j}$, $u_{3j}$, $r_{1j}$, $r_{2j}$, and $r_{3j}$ are the translations and rotations at joint **j**
- **dj2** is the distance you specify from joint **j** to the location where the shear deformation $d_{u2}$ is measured (the default is zero, meaning at joint **j**)
- **dj3** is the distance you specify from joint **j** to the location where the shear deformation $d_{u3}$ is measured (the default is zero, meaning at joint **j**)
- $L$ is the length of the element

All translations, rotations, and deformations are expressed in terms of the element local coordinate system.

Note that shear deformation can be caused by rotations as well as translations. These definitions ensure that all deformations will be zero under rigid-body motions of the element.

***Important!*** Note that **dj2** is the location where pure bending behavior is measured in the 1-2 plane, in other words, it is where the moment due to shear is taken to be zero. Likewise, **dj3** is the **location** where pure bending behavior is measured in the 1-3 plane.

It is important to note that the negatives of the rotations $r_{2i}$ and $r_{3j}$ have been used for the definition of shear and bending deformations in the 1-3 plane. This provides consistent definitions for shear and moment in both the Link/Support and Frame elements.

Three of these internal deformations are illustrated in Figure 51 (page 222).

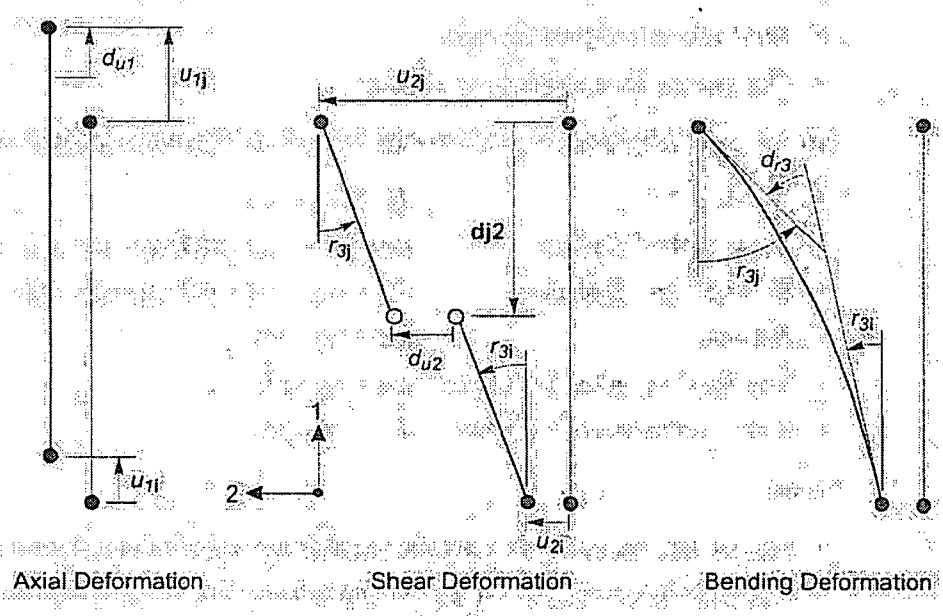


**Figure 51**

*Internal Deformations for a Two-Joint Link Element*

For *one-joint grounded-spring* elements the internal deformations are the same as above, except that the translations and rotations at joint **I** are taken to be zero:

- Axial: $d_{u1} = u_{1j}$
- Shear in the 1-2 plane: $d_{u2} = u_{2j} - \mathbf{dj2}\, r_{3j}$
- Shear in the 1-3 plane: $d_{u3} = u_{3j} + \mathbf{dj3}\, r_{2j}$
- Torsion: $d_{r1} = r_{1j}$
- Pure bending in the 1-3 plane: $d_{r2} = -r_{2j}$
- Pure bending in the 1-2 plane: $d_{r3} = r_{3j}$

# Link/Support Properties

A Link/Support Property is a set of structural properties that can be used to define the behavior of one or more Link or Support elements. Each Link/Support Property specifies the force-deformation relationships for the six internal deformations. Mass and weight properties may also be specified.

Link/Support Properties are defined independently of the Link and Support elements and are referenced during the definition of the elements.

There are two categories of Link/Support properties that can be defined:

- **Linear/Nonlinear.** A Linear/Nonlinear property set must be assigned to each Link or Support element.
- **Frequency-Dependent.** The assignment of a Frequency-Dependent property set to a Link or Support element is optional.

All Linear/Nonlinear property sets contain linear properties that are used by the element for linear analyses, and for other types of analyses if no other properties are defined. Linear/Nonlinear property sets may also have nonlinear properties that will be used for all nonlinear analyses, and for linear analyses that continue from nonlinear analyses.

Frequency-dependent property sets contain impedance (stiffness and damping) properties that will be used for all frequency-dependent analyses. If a Frequency-Dependent property has not been assigned to a Link/Support element, the linear properties for that element will be used for frequency-dependent analyses.

This is summarized in the table of Figure 52 (page 224).

## Local Coordinate System

Link/Support Properties are defined with respect to the local coordinate system of the Link or Support element. The local 1 axis is the longitudinal direction of the element and corresponds to extensional and torsional deformations. The local 2 and 3 directions correspond to shear and bending deformations.

See Topic "Local Coordinate System" (page 213) in this Chapter.

## Internal Spring Hinges

Each Link/Support Property is assumed to be composed of six internal "springs" or "Hinges," one for each of six internal deformations. Each "spring" may actually consist of several components, including springs and dashpots. The force-deformation relationships of these springs may be coupled or independent of each other.

Figure 53 (page 225) shows the springs for three of the deformations: axial, shear in the 1-2 plane, and pure-bending in the 1-2 plane. It is important to note that the shear spring is located a distance **dj2** from joint **j**. All shear deformation is assumed

| Analysis Case Type | Analysis Case Initial Conditions | Element has Nonlinear Properties? | Element has Freq. Dep. Properties? | Actual Property Used |
|---|---|---|---|---|
| Linear | Zero | Yes or No | Yes or No | Linear |
| | Nonlinear Case | No | Yes or No | Linear |
| | | Yes | Yes or No | Nonlinear |
| Nonlinear | Any | No | Yes or No | Linear |
| | | Yes | Yes or No | Nonlinear |
| Frequency Dependent | Zero | Yes or No | No | Linear |
| | | | Yes | Freq. Dep. |
| | Nonlinear Case | No | No | Linear |
| | | Yes | No | Nonlinear |
| | | Yes or No | Yes | Freq. Dep. |

**Figure 52**
*Link/Support Stiffness Properties Actually Used for Different Types of Analysis*

to occur in this spring; the links connecting this spring to the joints (or ground) are rigid in shear. Deformation of the shear spring can be caused by rotations as well as translations at the joints. The force in this spring will produce a linearly-varying moment along the length. This moment is taken to be zero at the shear spring, which acts as a moment hinge. The moment due to shear is independent of, and additive to, the constant moment in the element due to the pure-bending spring.

The other three springs that are not shown are for torsion, shear in the 1-3 plane, and pure-bending in the 1-3 plane. The shear spring is located a distance **dj3** from joint **j**.

The values of **dj2** and **dj3** may be different, although normally they would be the same for most elements.

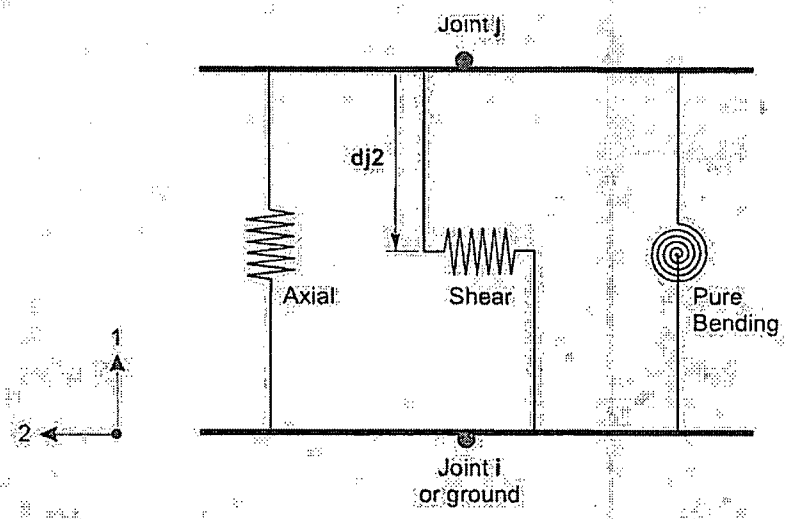


**Figure 53**
*Three of the Six Independent Spring Hinges in a Link/Support Element*

## Spring Force-Deformation Relationships

There are six force-deformation relationships that govern the behavior of the element, one for each of the internal springs:

- Axial: $f_{u1}$ vs. $d_{u1}$
- Shear: $f_{u2}$ vs. $d_{u2}$, $f_{u3}$ vs. $d_{u3}$
- Torsional: $f_{r1}$ vs. $d_{r1}$
- Pure bending: $f_{r2}$ vs. $d_{r2}$, $f_{r3}$ vs. $d_{r3}$

where $f_{u1}$, $f_{u2}$, and $f_{u3}$ are the internal-spring forces; and $f_{r1}$, $f_{r2}$, and $f_{r3}$ are the internal-spring moments.

Each of these relationships may be zero, linear only, or linear/nonlinear for a given Link/Support Property. These relationships may be independent or coupled. The forces and moments may be related to the deformation rates (velocities) as well as to the deformations.

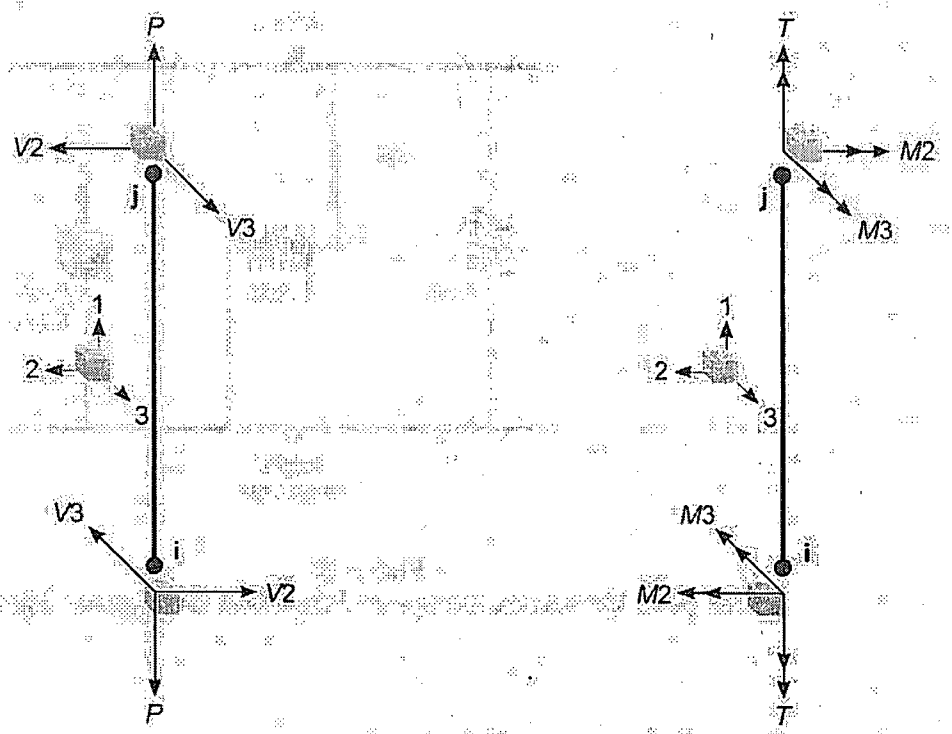


**Figure 54**
*Link/Support Element Internal Forces and Moments, Shown Acting at the Joints*

## Element Internal Forces

The Link/Support element internal forces, $P$, $V2$, $V3$, and the internal moments, $T$, $M2$, $M3$, have the same meaning as for the Frame element. These are illustrated in Figure 54 (page 226). These can be defined in terms of the spring forces and moments as:

- Axial: $P = f_{u1}$
- Shear in the 1-2 plane: $V2 = f_{u2}$, $M3_s = (d - \mathbf{dj2})\, f_{u2}$
- Shear in the 1-3 plane: $V3 = f_{u3}$, $M2_s = (d - \mathbf{dj3})\, f_{u3}$
- Torsion: $T = f_{r1}$
- Pure bending in the 1-3 plane: $M2_b = f_{r2}$
- Pure bending in the 1-2 plane: $M3_b = f_{r3}$

where $d$ is the distance from joint j. The total bending-moment resultants $M2$ and $M3$ composed of shear and pure-bending parts:

$$M2 = M2_s + M2_b$$
$$M3 = M3_s + M3_b$$

These internal forces and moments are present at every cross section along the length of the element.

See Topic "Internal Force Output" (page 117) in Chapter "The Frame Element."

## Uncoupled Linear Force-Deformation Relationships

If each of the internal springs are linear and uncoupled, the spring force-deformation relationships can be expressed in matrix form as:

$$\begin{Bmatrix} f_{u1} \\ f_{u2} \\ f_{u3} \\ f_{r1} \\ f_{r2} \\ f_{r3} \end{Bmatrix} = \begin{bmatrix} k_{u1} & 0 & 0 & 0 & 0 & 0 \\ & k_{u2} & 0 & 0 & 0 & 0 \\ & & k_{u3} & 0 & 0 & 0 \\ & & & k_{r1} & 0 & 0 \\ & sym. & & & k_{r2} & 0 \\ & & & & & k_{r3} \end{bmatrix} \begin{Bmatrix} d_{u1} \\ d_{u2} \\ d_{u3} \\ d_{r1} \\ d_{r2} \\ d_{r3} \end{Bmatrix} \qquad \text{(Eqn. 1)}$$

where $k_{u1}$, $k_{u2}$, $k_{u3}$, $k_{r1}$, $k_{r2}$, and $k_{r3}$ are the linear stiffness coefficients of the internal springs.

This can be recast in terms of the element internal forces and displacements at joint j for a one-joint element as:

$$\begin{Bmatrix} P \\ V2 \\ V3 \\ T \\ M2 \\ M3 \end{Bmatrix}_{\mathrm{j}} = \begin{bmatrix} k_{u1} & 0 & 0 & 0 & 0 & 0 \\ & k_{u2} & 0 & 0 & 0 & -\mathbf{dj2}\, k_{u2} \\ & & k_{u3} & 0 & -\mathbf{dj3}\, k_{u3} & 0 \\ & & & k_{r1} & 0 & 0 \\ & sym. & & & k_{r2} + \mathbf{dj3}^2\, k_{u3} & 0 \\ & & & & & k_{r3} + \mathbf{dj2}^2\, k_{u2} \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \\ r_1 \\ -r_2 \\ r_3 \end{Bmatrix}_{\mathrm{j}} \qquad \text{(Eqn. 2)}$$

This relationship also holds for a two-joint element if all displacements at joint I are zero.

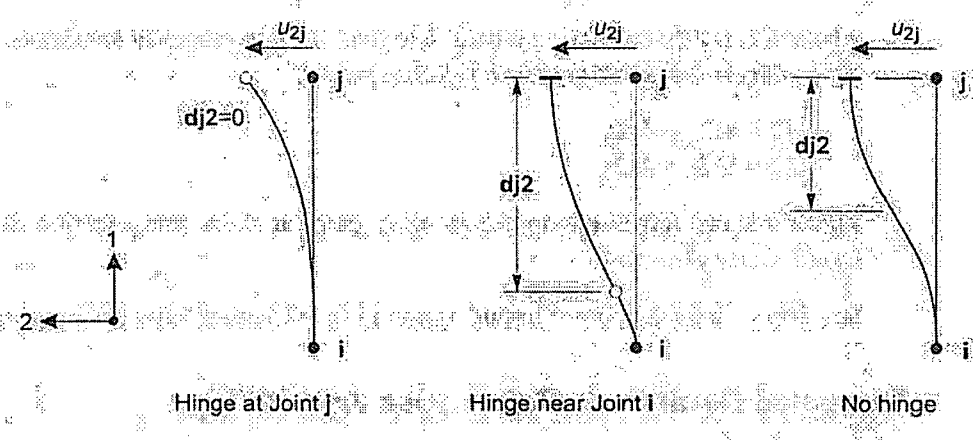


**Figure 55**
*Location of Shear Spring at a Moment Hinge or Point of Inflection*

Similar relationships hold for linear damping behavior, except that the stiffness terms are replaced with damping coefficients, and the displacements are replaced with the corresponding velocities.

Consider an example where the equivalent shear and bending springs are to be computed for a prismatic beam with a section bending stiffness of $EI$ in the 1-2 plane. The stiffness matrix at joint **j** for the 1-2 bending plane is:

$$\begin{Bmatrix} V2 \\ M3 \end{Bmatrix}_{\mathbf{j}} = \frac{EI}{L^3}\begin{bmatrix} 12 & -6L \\ -6L & 4L^2 \end{bmatrix}\begin{Bmatrix} u_2 \\ r_3 \end{Bmatrix}_{\mathbf{j}}$$

From this it can be determined that the equivalent shear spring has a stiffness of $k_{u2} = 12\frac{EI}{L^3}$ located at $\mathbf{dj2} = \frac{L}{2}$, and the equivalent pure-bending spring has a stiffness of $k_{r3} = \frac{EI}{L}$.

For an element that possesses a true moment hinge in the 1-2 bending plane, the pure-bending stiffness is zero, and **dj2** is the distance to the hinge. See Figure 55 (page 228).

### Types of Linear/Nonlinear Properties

The primary Linear/Nonlinear Link/Support Properties may be of the following types:

- Coupled Linear
- Damper
- Gap
- Hook
- Multi-linear Elastic
- Multi-linear Plastic
- Plastic (Wen)
- Hysteretic (Rubber) Isolator
- Friction-Pendulum Isolator
- Tension/Compression Friction Pendulum Isolator

The first type, Coupled Linear, may have fully coupled linear stiffness and damping coefficients. This property type is described in Topic "Coupled Linear Property" (page 229) in this Chapter.

All other property types are considered nonlinear. However, for each nonlinear property type you also specify a set of uncoupled linear stiffness and damping coefficients that are used instead of the nonlinear properties for linear analyses. These substitute linear properties are called "linear effective stiffness" and "linear effective damping" properties.

For more information:

- See Topic "Coupled Linear Property" (page 229) in this Chapter.
- See Chapter "The Link/Support Element—Advanced" (page 233).

## Coupled Linear Property

The Coupled Linear Link/Support Property is fully linear. It has no nonlinear behavior. The linear behavior is used for all linear and nonlinear analyses. It is also used for frequency-dependent analyses unless frequency-dependent properties have been assigned to the Link/Support element.

The stiffness matrix of Eqn. (1) (page 227) may now be fully populated:

$$\begin{Bmatrix} f_{u1} \\ f_{u2} \\ f_{u3} \\ f_{r1} \\ f_{r2} \\ f_{r3} \end{Bmatrix} = \begin{bmatrix} k_{u1} & k_{u1u2} & k_{u1u3} & k_{u1r1} & k_{u1r2} & k_{u1r3} \\ & k_{u2} & k_{u2u3} & k_{u2r1} & k_{u2r2} & k_{u2r3} \\ & & k_{u3} & k_{u3r1} & k_{u3r2} & k_{u3r3} \\ & & & k_{r1} & k_{r1r2} & k_{r1r3} \\ & sym. & & & k_{r2} & k_{r2r3} \\ & & & & & k_{r3} \end{bmatrix} \begin{Bmatrix} d_{u1} \\ d_{u2} \\ d_{u3} \\ d_{r1} \\ d_{r2} \\ d_{r3} \end{Bmatrix} \qquad \text{(Eqn. 3)}$$

where $k_{u1}, k_{u1u2}, k_{u2}, k_{u1u3}, k_{u2u3}, k_{u3}, \ldots, k_{r3}$ are the linear stiffness coefficients of the internal springs.

The corresponding matrix of Eqn. (2) (page 227) can be developed from the relationships that give the element internal forces in terms of the spring forces and moments. See Topic "Element Internal Forces" (page 226) in this Chapter.

Similarly, the damping matrix is fully populated and has the same form as the stiffness matrix. Note that the damping behavior is active for all dynamic analyses. This is in contrast to linear effective damping, which is not active for nonlinear analyses.

# Mass

In a dynamic analysis, the mass of the structure is used to compute inertial forces. The mass contributed by the Link or Support element is lumped at the joints **I** and **j**. *No inertial effects are considered within the element itself.*

For each Link/Support Property, you may specify a total translational mass, **m**. Half of the mass is assigned to the three translational degrees of freedom at each of the element's one or two joints. For single-joint elements, half of the mass is assumed to be grounded.

You may additionally specify total rotational mass moments of inertia, **mr1**, **mr2**, and **mr3**, about the three local axes of each element. Half of each mass moment of inertia is assigned to each of the element's one or two joints. For single-joint elements, half of each mass moment of inertia is assumed to be grounded.

The rotational inertias are defined in the element local coordinate system, but will be transformed by the program to the local coordinate systems for joint **I** and **j**. If the three inertias are not equal and element local axes are not parallel to the joint local axes, then cross-coupling inertia terms will be generated during this transformation. These will be discarded by the program, resulting in some error.

It is *strongly recommended* that there be mass corresponding to each nonlinear deformation load in order to generate appropriate Ritz vectors for nonlinear modal time-history analysis. Note that rotational inertia is needed as well as translational mass for nonlinear shear deformations if either the element length or **dj** is non-zero.

For more information:

- See Chapter "Static and Dynamic Analysis" (page 287).
- See Topic "Nonlinear Deformation Loads" (page 231) in this Chapter.

## Self-Weight Load

Self-Weight Load activates the self-weight of all elements in the model. For each Link/Support Property, a total self-weight, **w**, may be defined. Half of this weight is assigned to each joint of each Link/Support element using that Link/Support Property. For single-joint elements, half of the weight is assumed to be grounded.

Self-Weight Load always acts downward, in the global –Z direction. You may scale the self-weight by a single scale factor that applies equally to all elements in the structure.

See Topic "Self-Weight Load" (page 275) in Chapter "Load Cases" for more information.

## Gravity Load

Gravity Load can be applied to each Link/Support element to activate the self-weight of the element. Using Gravity Load, the self-weight can be scaled and applied in any direction. Different scale factors and directions can be applied to each element.

If all elements are to be loaded equally and in the downward direction, it is more convenient to use Self-Weight Load.

For more information:

- See Topic "Self-Weight Load" (page 231) in this Chapter for the definition of self-weight for the Link/Support element.
- See Topic "Gravity Load" (page 276) in Chapter "Load Cases."

# Internal Force and Deformation Output

Link/Support element internal forces and deformations can be requested for analysis cases and combinations.

Results for linear analyses are based upon the linear effective-stiffness and effective-damping properties and do not include any nonlinear effects. Only the results for nonlinear analysis cases include nonlinear behavior.

The element internal forces were defined in Subtopic "Element Internal Forces" (page 226) of this Chapter. The internal deformations were defined in Topic "Internal Deformations" (page 220) of this Chapter.

The element internal forces are labeled P, V2, V3, T, M2, and M3 in the output. The internal deformations are labeled U1, U2, U3, R1, R2, and R3 in the output, corresponding to the values of $d_{u1}$, $d_{u2}$, $d_{u3}$, $d_{r1}$, $d_{r2}$, and $d_{r3}$.

For more information:

- See Chapter "Load Cases" (page 271).
- See Chapter "Analysis Cases" (page 287).

Chapter XV

# The Link/Support Element—Advanced

The basic, linear behavior of the Link and Support elements was described in the previous Chapter. The present Chapter describes the use of the Link and Support elements to model nonlinear behavior and frequency-dependent behavior.

**Advanced Topics**

- Overview
- Nonlinear Link/Support Properties
- Linear Effective Stiffness
- Linear Effective Damping
- Nonlinear Viscous Damper Property
- Gap Property
- Hook Property
- Multi-Linear Elasticity Property
- Wen Plasticity Property
- Multi-Linear Kinematic Plasticity Property
- Multi-Linear Takeda Plasticity Property
- Multi-Linear Pivot Hysteretic Plasticity Property

- Hysteretic (Rubber) Isolator Property
- Friction-Pendulum Isolator Property
- Double-Acting Friction-Pendulum Isolator Property
- Nonlinear Deformation Loads
- Frequency-Dependent Properties

## Overview

The basic features of the Link and Support elements were described in the previous Chapter, "The Link/Support Element—Basic" (page 211).

This Chapter describes the various type of nonlinear properties that are available, the concepts of linear effective stiffness and damping, the use of nonlinear deformation loads for Ritz-vector analysis, and frequency-dependent properties.

## Nonlinear Link/Support Properties

The **nonlinear properties** for each Link/Support Property must be of one of the various types described below. The type determines which degrees of freedom may be nonlinear and the kinds of nonlinear force-deformation relationships available for those degrees of freedom.

*Every* degree of freedom may have linear effective-stiffness and effective-damping properties specified, as described below in Subtopics "Linear Effective Stiffness" and "Linear Effective Damping."

During *nonlinear analysis*, the nonlinear force-deformation relationships are used at all degrees of freedom for which nonlinear properties were specified. For all other degrees of freedom, the linear effective stiffnesses are used during a nonlinear analysis.

Linear analyses that start from zero initial conditions will use the linear effective stiffness regardless of whether nonlinear properties were specified or not. Linear analyses that use the stiffness from the end of a previous nonlinear analysis will use the nonlinear properties. Linear effective damping is used for all linear analyses, but it is not used for any nonlinear analysis.

Each nonlinear force-deformation relationship includes a stiffness coefficient, **k**. This represents the linear stiffness when the nonlinear effect is negligible, e.g., for rapid loading of the Damper; for a closed Gap or Hook; or in the absence of yield-

ing or slipping for the Plastic1, Isolator1, or Isolator2 properties. If **k** is zero, no nonlinear force can be generated for that degree of freedom, with the exception of the pendulum force in the Isolator2 property.

*IMPORTANT!* You may sometimes be tempted to specify very large values for **k**, particularly for Damper, Gap, and Hook properties. Resist this temptation! If you want to limit elastic deformations in a particular internal spring, it is usually sufficient to use a value of **k** that is from $10^3$ to $10^4$ times as large as the corresponding stiffness in any connected elements. Larger values of **k** may cause numerical difficulties during solution. See the additional discussion for the Damper property below.

# Linear Effective Stiffness

For each nonlinear type of Link/Support Property, you may specify six uncoupled linear effective-stiffness coefficients, **ke**, one for each of the internal springs.

The **linear effective stiffness** represents the total elastic stiffness for the Link/Support element that is used for *all linear analyses that start from zero initial conditions. The actual nonlinear properties are ignored for these types of analysis.*

If you do not specify nonlinear properties for a particular degree of freedom, then the linear effective stiffness is used for that degree of freedom for all linear and nonlinear analyses.

The effective force-deformation relationships for the Link/Support Properties are given by Equation 1 above with the appropriate values of **ke** substituted for $k_{u1}$, $k_{u2}$, $k_{u3}$, $k_{r1}$, $k_{r2}$, and $k_{r3}$.

## Special Considerations for Modal Analyses

The effective stiffness properties are not used for nonlinear degrees of freedom during nonlinear time-history analysis. However, nonlinear *modal* time-history analyses do make use of the vibration modes that are computed based on the effective stiffness if the modal analysis itself start from zero initial conditions. During time integration the behavior of these modes is modified so that the structural response reflects the actual stiffness and other nonlinear parameters specified. The rate of convergence of the nonlinear iteration may be improved by changing the effective stiffness.

Following are some guidelines for selecting the linear effective stiffness. You should deviate from these as necessary to achieve your modeling and analysis

goals. In particular, you should consider whether you are more interested in the results to be obtained from linear analyses, or in obtaining modes that are used as the basis for nonlinear modal time-history analyses.

- When carrying out analyses based on the UBC '94 code or similar, the effective stiffness should usually be the code-defined maximum effective stiffness
- For Gap and Hook elements the effective stiffness should usually be zero or **k**, depending on whether the element is likely to be open or closed, respectively, in normal service
- For Damper elements, the effective stiffness should usually be zero
- For other elements, the stiffness should be between zero and **k**
- If you have chosen an artificially large value for **k**, be sure to use a much smaller value for **ke** to help avoid numerical problems in nonlinear modal time-history analyses

In the above, **k** is the nonlinear stiffness property for a given degree of freedom. See Chapter "The Link/Support Element—Basic" (page 211).

For more information, see Topic "Nonlinear Modal Time-History Analysis (FNA)" (page 295) in Chapter "Nonlinear Time-History Analysis."

## Linear Effective Damping

For each nonlinear-type of Link/Support Property, you may specify six uncoupled linear effective-damping coefficients, **ce**, one for each of the internal springs. By default, each coefficient **ce** is equal to zero.

The **linear effective damping** represents the total viscous damping for the Link/Support element that is used for response-spectrum analyses, for linear and periodic time-history analyses, and for frequency-dependent analyses if frequency-dependent properties have not been assigned to a given Link or Support element. The actual nonlinear properties are ignored for these types of analysis. Effective damping can be used to represent energy dissipation due to nonlinear damping, plasticity, or friction.

The effective force/deformation-rate relationships for the Link/Support Properties are given by Equation 1 above with the appropriate values of **ce** substituted for $k_{u1}$, $k_{u2}$, $k_{u3}$, $k_{r1}$, $k_{r2}$, and $k_{r3}$, and deformation rates substituted for the corresponding deformations.

For response-spectrum and linear modal time-history analysis, the effective damping values are converted to modal damping ratios assuming proportional damping, i.e., the modal cross-coupling damping terms are ignored. These effective modal-damping values are added to any other modal damping that you specify directly. The program will not permit the total damping ratio for any mode to exceed 99.995%.

***Important Note:*** Modal cross-coupling damping terms can be very significant for some structures. A linear analysis based on effective-damping properties may grossly overestimate or underestimate the amount of damping present in the structure.

Nonlinear time-history analysis is strongly recommended to determine the effect of added energy dissipation devices. Nonlinear time-history analysis does not use the effective damping values since it accounts for energy dissipation in the elements directly, and correctly accounts for the effects of modal cross-coupling.

## Nonlinear Viscous Damper Property

This element is very well suited for modeling viscous dampers that have a nonlinear force-velocity relationship. For simple linear damping, you may instead want to use the coupled linear Link Support Property. The linear property does not require the series spring used by the nonlinear viscous damper, and it does allow you to consider a parallel spring. See Topic "Coupled Linear Property" (page 229) for more information

For the nonlinear viscous damper, you can specify independent damping properties for each deformational degree of freedom. The damping properties are based on the Maxwell model of viscoelasticity (Malvern, 1969) having a nonlinear damper in series with a spring. See Figure 56 (page 238). If you do not specify nonlinear properties for a degree of freedom, that degree of freedom is linear using the effective stiffness, which may be zero.

The nonlinear force-deformation relationship is given by:

$$f = \mathbf{k}\, d_k = \mathbf{c}\, \dot{d}_c^{\,\mathbf{cexp}}$$

where **k** is the spring constant, **c** is the damping coefficient, **cexp** is the damping exponent, $d_k$ is the deformation across the spring, and $\dot{d}_c$ is the deformation rate across the damper. The damping exponent must be positive; the practical range is between 0.2 and 2.0.

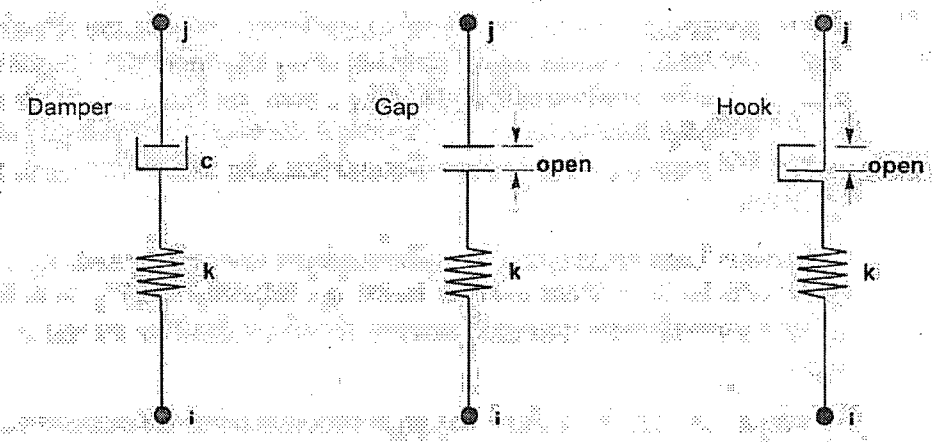


**Figure 56**
*Nonlinear Viscous Damper, Gap, and Hook Property Types, Shown for Axial Deformations*

The spring and damping deformations sum to the total internal deformation:

$$d = d_k + d_c$$

The series spring is very important for capturing realistic behavior of nonlinear dampers, especially those with fractional exponents. It represents the elastic flexibility of the damping device, including the fluid column and the connecting mechanisms. It prevents the damping term from producing unrealistically large viscous forces at small velocities, which can have a *very significant* impact on overall structural behavior.

You may be tempted to introduce a large stiffness value, **k**, to represent "pure" damping, but this may result in unconservative and unrealistic behavior. It would be better to get a realistic value of the elastic flexibility from the manufacturer of the device and the details of the connections, or make an engineering estimate of the value. For more information, see the *SAP2000 Software Verification Manual*, where SAP2000 results are compared with experiment.

## Gap Property

For each deformational degree of freedom you may specify independent gap ("compression-only") properties. See Figure 56 (page 238).

All internal deformations are independent. The opening or closing of a gap for one deformation does not affect the behavior of the other deformations.

If you do not specify nonlinear properties for a degree of freedom, that degree of freedom is linear using the effective stiffness, which may be zero.

The nonlinear force-deformation relationship is given by:

$$f = \begin{cases} \mathbf{k}(d + \mathbf{open}) & \text{if } d + \mathbf{open} < 0 \\ 0 & \text{otherwise} \end{cases}$$

where **k** is the spring constant, and **open** is the initial gap opening, which must be zero or positive.

## Hook Property

For each deformational degree of freedom you may specify independent hook ("tension-only") properties. See Figure 56 (page 238).

All internal deformations are independent. The opening or closing of a hook for one deformation does not affect the behavior of the other deformations.

If you do not specify nonlinear properties for a degree of freedom, that degree of freedom is linear using the effective stiffness, which may be zero.

The nonlinear force-deformation relationship is given by:

$$f = \begin{cases} \mathbf{k}(d - \mathbf{open}) & \text{if } d - \mathbf{open} > 0 \\ 0 & \text{otherwise} \end{cases}$$

where **k** is the spring constant, and **open** is the initial hook opening, which must be zero or positive.

## Multi-Linear Elasticity Property

For each deformational degree of freedom you may specify multi-linear elastic properties.

All internal deformations are independent. The deformation in one degree of freedom does not affect the behavior of any other. If you do not specify nonlinear properties for a degree of freedom, that degree of freedom is linear using the effective stiffness, which may be zero.

The nonlinear force-deformation relationship is given by a multi-linear curve that you define by a set of points. The curve can take on almost any shape, with the following restrictions:

- One point must be the origin, (0,0)
- At least one point with positive deformation, and one point with negative deformation, must be defined
- The deformations of the specified points must increase monotonically, with no two values being equal
- The forces (moments) can take on any value

The slope given by the last two specified points on the positive deformation axis is extrapolated to infinite positive deformation. Similarly, the slope given by the last two specified points on the negative deformation axis is extrapolated to infinite negative deformation.

The behavior is nonlinear but it is elastic. This means that the element loads and unloads along the same curve, and no energy is dissipated.

# Wen Plasticity Property

For each deformational degree of freedom you may specify independent uniaxial-plasticity properties. The plasticity model is based on the hysteretic behavior proposed by Wen (1976). See Figure 57 (page 241).

All internal deformations are independent. The yielding at one degree of freedom does not affect the behavior of the other deformations.

If you do not specify nonlinear properties for a degree of freedom, that degree of freedom is linear using the effective stiffness, which may be zero.

The nonlinear force-deformation relationship is given by:

$$f = \mathbf{ratio}\ \mathbf{k}\ d + (1 - \mathbf{ratio})\ \mathbf{yield}\ z$$

where **k** is the elastic spring constant, **yield** is the yield force, **ratio** is the specified ratio of post-yield stiffness to elastic stiffness (**k**), and $z$ is an internal hysteretic variable. This variable has a range of $|z| \le 1$, with the yield surface represented by $|z| = 1$. The initial value of $z$ is zero, and it evolves according to the differential equation:

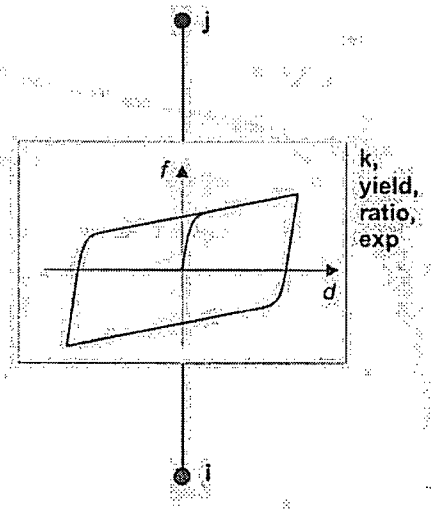


**Figure 57**
*Wen Plasticity Property Type for Uniaxial Deformation*

$$\dot{z} = \frac{\mathbf{k}}{\mathbf{yield}} \begin{cases} \dot{d}\,(1 - |z|^{\mathbf{exp}}) & \text{if } \dot{d}\,z > 0 \\ \dot{d} & \text{otherwise} \end{cases}$$

where **exp** is an exponent greater than or equal to unity. Larger values of this exponent increases the sharpness of yielding as shown in Figure 58 (page 242). The practical limit for **exp** is about 20. The equation for $z$ is equivalent to Wen's model with $A = 1$ and $\alpha = \beta = 0.5$.

## Multi-Linear Kinematic Plasticity Property

This model is based upon kinematic hardening behavior that is commonly observed in metals. For each deformational degree of freedom you may specify multi-linear kinematic plasticity properties. See Figure 59 (page 243).

All internal deformations are independent. The deformation in one degree of freedom does not affect the behavior of any other. If you do not specify nonlinear properties for a degree of freedom, that degree of freedom is linear using the effective stiffness, which may be zero.

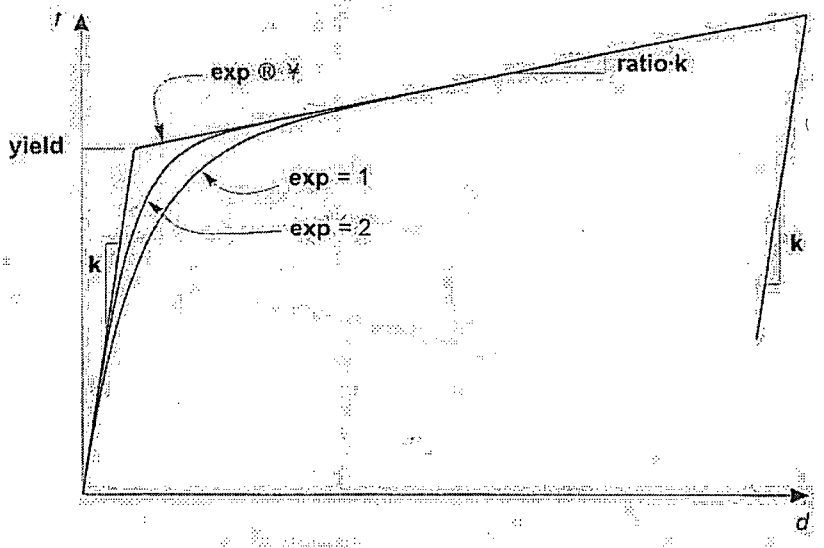


**Figure 58**
*Definition of Parameters for the Wen Plasticity Property*

The nonlinear force-deformation relationship is given by a multi-linear curve that you define by a set of points. The curve can take on almost any shape, with the following restrictions:

- One point must be the origin, (0,0)
- At least one point with positive deformation, and one point with negative deformation, must be defined
- The deformations of the specified points must increase monotonically, with no two values being equal
- The forces (moments) at a point must have the same sign as the deformation (they can be zero)
- The final slope at each end of the curve must not be negative

The slope given by the last two points specified on the positive deformation axis is extrapolated to infinite positive deformation. Similarly, the slope given by the last two points specified on the negative deformation axis is extrapolated to infinite negative deformation.

The given curve defines the force-deformation relationship under monotonic loading. The first slope on either side of the origin is elastic; the remaining segments de-

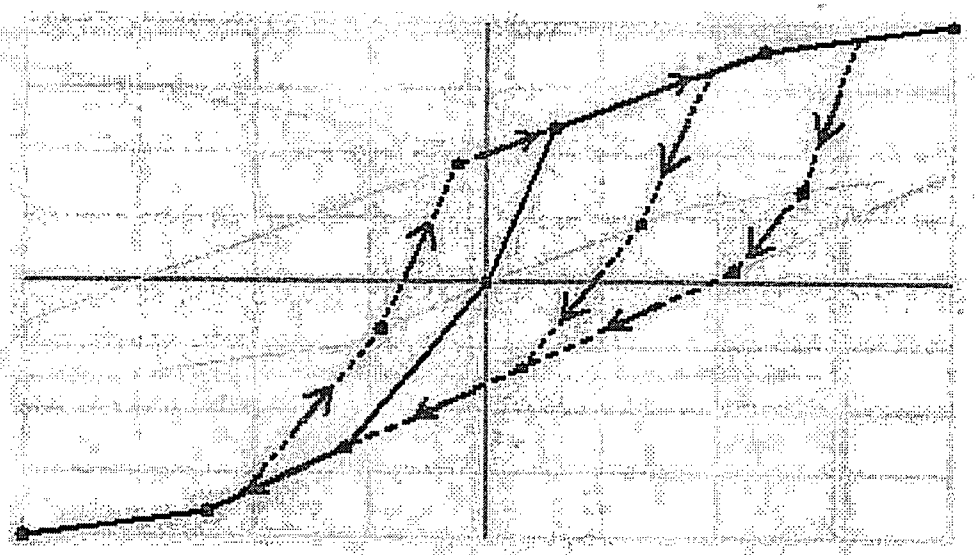

**Figure 59**
*Multi-linear Kinematic Plasticity Property Type for Uniaxial Deformation*

fine plastic deformation. If the deformation reverses, it follows the two elastic segments before beginning plastic deformation in the reverse direction.

Under the rules of kinematic hardening, plastic deformation in one direction "pulls" the curve for the other direction along with it. Matching pairs of points are linked.

Consider the points labeled as follows:

- The origin is point 0
- The points on the positive axis are labeled 1, 2, 3..., counting from the origin.
- The points on the negative axis are labeled –1, –2, –3..., counting from the origin.

See Figure 60 (page 244) for an example, where three points are defined on either side of the origin. This figure shows the behavior under cyclic loading of increasing magnitude.

In this example, the loading is initially elastic from point 0 to point 1. As loading continues from point 1 to point 2, plastic deformation occurs. This is represented by the movement of point 1 along the curve toward point 2. Point –1 is pulled by point

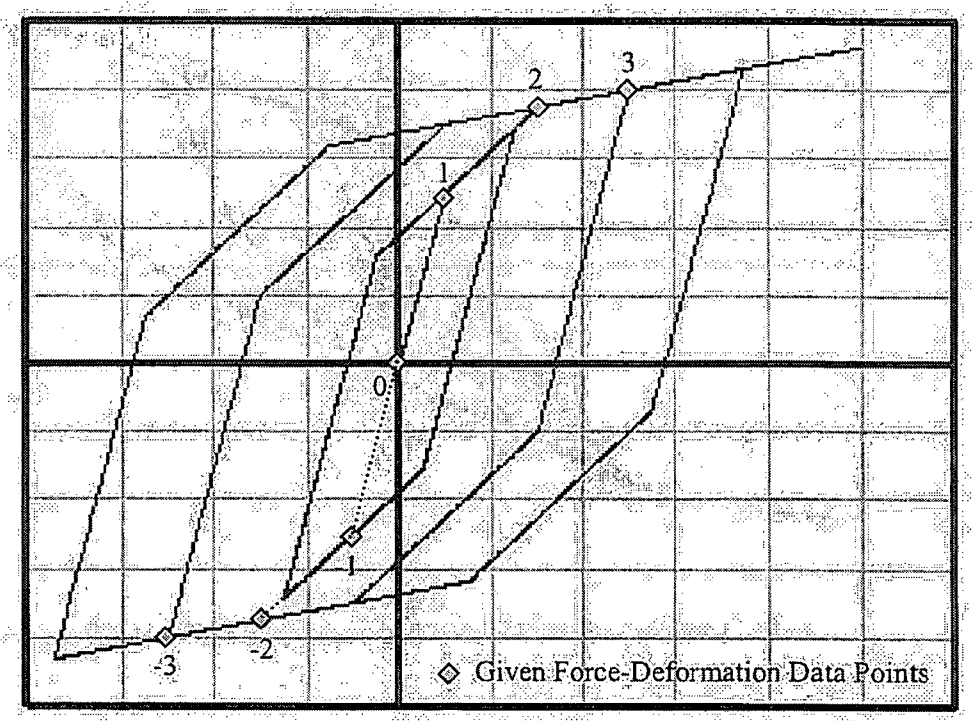


**Figure 60**
*Multi-linear Kinematic Plasticity Property Type for Uniaxial Deformation*
*Shown is the behavior under cyclic loading of increasing magnitude*

1 to move an identical amount in both the force and deformation directions. Point 0 also moves along with point 1 and –1 to preserve the elastic slopes.

When the load reverses, the element unloads along the shifted elastic line from point 1 to point –1, then toward point –2. Point –2 has not moved yet, and will not move until loading in the negative direction pushes it, or until loading in the positive direction pushes point 2, which in turn pulls point –2 by an identical amount.

When the load reverses again, point 1 is pushed toward point 2, then together they are pushed toward point 3, pulling points –1 and –2 with them. This procedure is continued throughout the rest of the analysis. The slopes beyond points 3 and –3 are maintained even as these points move.

When you define the points on the multi-linear curve, you should be aware that symmetrical pairs of points will be linked, even if the curve is not symmetrical. This gives you some control over the shape of the hysteretic loop.

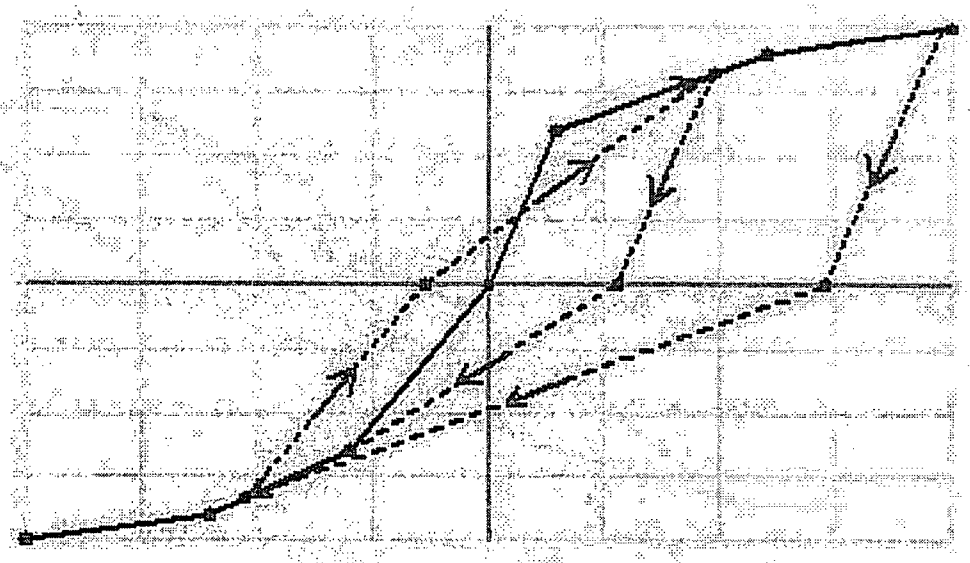

**Figure 61**
*Multi-linear Takeda Plasticity Property Type for Uniaxial Deformation*

## Multi-Linear Takeda Plasticity Property

This model is very similar to the Multi-Linear Kinematic model, but uses a degrading hysteretic loop based on the Takeda model, as described in Takeda, Sozen, and Nielsen (1970). The specification of the properties is identical to that for the Kinematic model, only the behavior is different. In particular, when crossing the horizontal axis upon unloading, the curve follows a secant path to the backbone force deformation relationship for the opposite loading direction. See Figure 61 (page 245).

## Multi-Linear Pivot Hysteretic Plasticity Property

This model is similar to the Multi-Linear Takeda model, but has additional parameters to control the degrading hysteretic loop. It is particularly well suited for reinforced concrete members, and is based on the observation that unloading and reverse loading tend to be directed toward specific points, called pivots points, in the force-deformation (or moment-rotation) plane. This model is fully described in Dowell, Scible, and Wilson (1998).

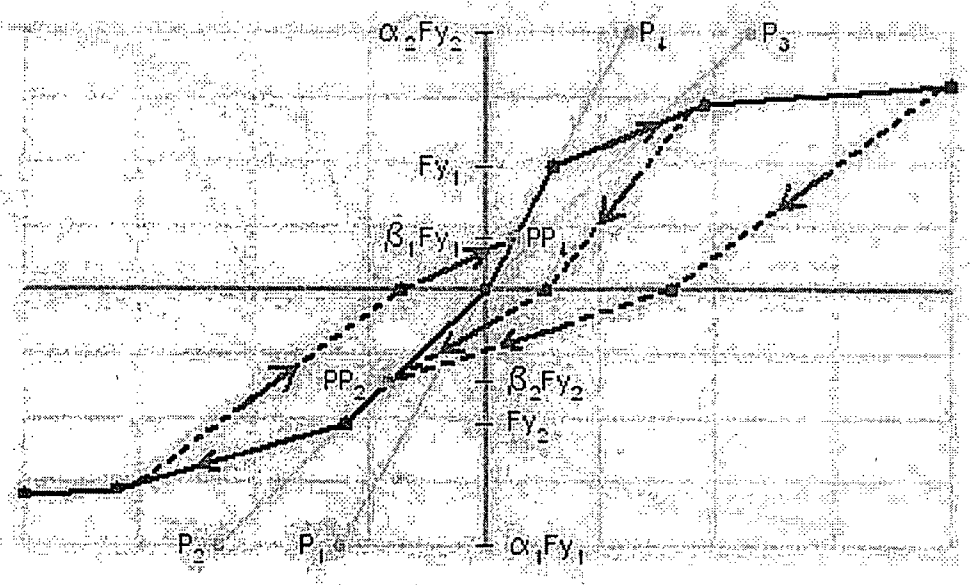


**Figure 62**
*Multi-linear Takeda Plasticity Property Type for Uniaxial Deformation*

The specification of the properties is identical to that for the Kinematic or Takeda model, with the addition of the following scalar parameters:

- α1, which locates the pivot point for unloading to zero from positive force
- α2, which locates the pivot point for unloading to zero from negative force
- β1, which locates the pivot point for reverse loading from zero toward positive force
- β2, which locates the pivot point for reverse loading from zero toward negative force
- η, which determines the amount of degradation of the elastic slopes after plastic deformation.

These parameters are illustrated in Figure 62 (page 246).

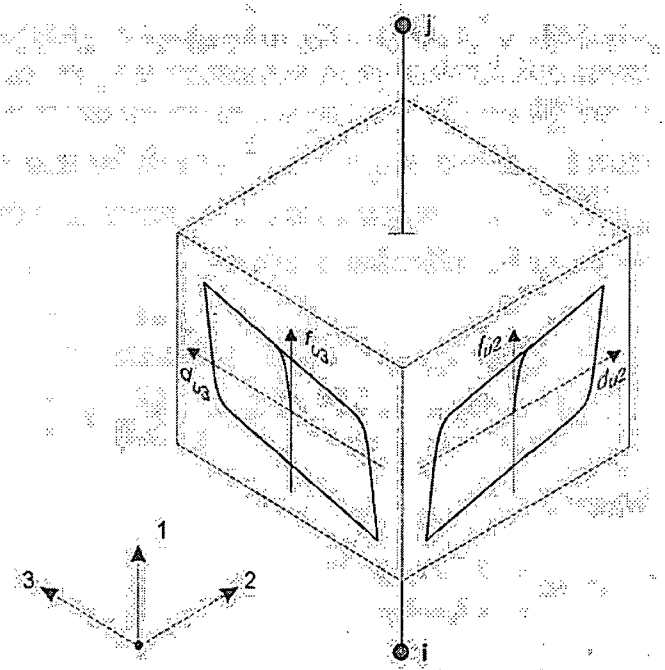


**Figure 63**
*Hysteretic Isolator Property for Biaxial Shear Deformation*

## Hysteretic (Rubber) Isolator Property

This is a biaxial hysteretic isolator that has coupled plasticity properties for the two shear deformations, and linear effective-stiffness properties for the remaining four deformations. The plasticity model is based on the hysteretic behavior proposed by Wen (1976), and Park, Wen and Ang (1986), and recommended for base-isolation analysis by Nagarajaiah, Reinhorn and Constantinou (1991). See Figure 63 (page 247).

For each *shear* deformation degree of freedom you may independently specify either linear or nonlinear behavior:

- If both shear degrees of freedom are nonlinear, the coupled force-deformation relationship is given by:

$$f_{u2} = \mathbf{ratio2}\ \mathbf{k2}\ d_{u2} + (1 - \mathbf{ratio2})\ \mathbf{yield2}\ z_2$$
$$f_{u3} = \mathbf{ratio3}\ \mathbf{k3}\ d_{u3} + (1 - \mathbf{ratio3})\ \mathbf{yield3}\ z_3$$

where **k2** and **k3** are the elastic spring constants, **yield2** and **yield3** are the yield forces, **ratio2** and **ratio3** are the ratios of post-yield stiffnesses to elastic stiffnesses (**k2** and **k3**), and $z_2$ and $z_3$ are internal hysteretic variables. These variables have a range of $\sqrt{z_2^2 + z_3^2} \le 1$, with the yield surface represented by $\sqrt{z_2^2 + z_3^2} = 1$. The initial values of $z_2$ and $z_3$ are zero, and they evolve according to the differential equations:

$$\begin{Bmatrix} \dot{z}_2 \\ \dot{z}_3 \end{Bmatrix} = \begin{bmatrix} 1 - a_2\, z_2^2 & -a_3\, z_2\, z_3 \\ -a_2\, z_2\, z_3 & 1 - a_3\, z_3^2 \end{bmatrix} \begin{Bmatrix} \dfrac{\mathbf{k2}}{\mathbf{yield2}}\, \dot{d}_{u2} \\ \dfrac{\mathbf{k3}}{\mathbf{yield3}}\, \dot{d}_{u3} \end{Bmatrix}$$

Where:

$$a_2 = \begin{cases} 1 & \text{if } \dot{d}_{u2}\, z_2 > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$a_3 = \begin{cases} 1 & \text{if } \dot{d}_{u3}\, z_3 > 0 \\ 0 & \text{otherwise} \end{cases}$$

These equations are equivalent to those of Park, Wen and Ang (1986) with $A = 1$ and $\beta = \gamma = 0.5$.

- If only one shear degree of freedom is nonlinear, the above equations reduce to the uniaxial plasticity behavior of the Plastic1 property with **exp** = 2 for that degree of freedom.

A linear spring relationship applies to the axial deformation, the three moment deformations, and to any shear deformation without nonlinear properties. All linear degrees of freedom use the corresponding effective stiffness, which may be zero.

## Friction-Pendulum Isolator Property

This is a biaxial friction-pendulum isolator that has coupled friction properties for the two shear deformations, post-slip stiffness in the shear directions due the pendulum radii of the slipping surfaces, gap behavior in the axial direction, and linear effective-stiffness properties for the three moment deformations. See Figure 64 (page 249).

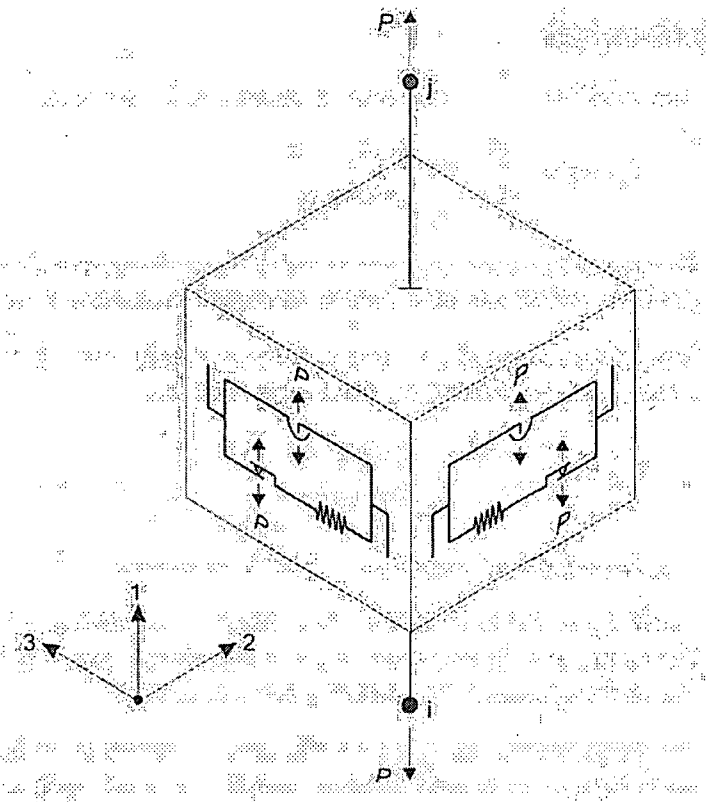


**Figure 64**
*Friction-Pendulum Isolator Property for Biaxial Shear Behavior*
*This element can be used for gap-friction contact problems*

This element can also be used to model gap and friction behavior between contacting surfaces by setting the radii to zero, indicating a flat surface.

The friction model is based on the hysteretic behavior proposed by Wen (1976), and Park, Wen and Ang (1986), and recommended for base-isolation analysis by Nagarajaiah, Reinhorn and Constantinou (1991). The pendulum behavior is as recommended by Zayas and Low (1990).

The friction forces and pendulum forces are directly proportional to the compressive axial force in the element. The element cannot carry axial tension.

## Axial Behavior

The axial force, $f_{u1}$, is *always* nonlinear, and is given by:

$$f_{u1} = P = \begin{cases} \mathbf{k1}\, d_{u1} & \text{if } d_{u1} < 0 \\ 0 & \text{otherwise} \end{cases}$$

In order to generate nonlinear shear force in the element, the stiffness **k1** must be positive, and hence force $P$ must be negative (compressive).

You may additionally specify a damping coefficient, **c1**, for the axial degree of freedom, in which case the axial force becomes:

$$f_{u1} = P + \begin{cases} \mathbf{c1}\, \dot{d}_{u1} & \text{if } d_{u1} < 0 \\ 0 & \text{otherwise} \end{cases}$$

The damping force only exists when the isolator is in compression.

Force $f_{u1}$ is the total axial force exerted by the element on the connected joints. However, only the stiffness force $P$ is assumed to act on the bearing surface, causing shear resistance. The damping force is external.

The purpose of the damping coefficient is to reduce the numerical chatter (oscillation) that can be present in some analyses. You can estimate the damping coefficient needed to achieve a certain ratio, $r$, of critical damping (e.g., $r = 0.05$) from the formula

$$r = \frac{\mathbf{c1}}{2\sqrt{\mathbf{k1}\, m}}$$

where $m$ is the tributary mass for the isolator, which could be estimated from the self-weight axial force divided by the acceleration due to gravity. It is up to you to verify the applicability of this approach for your particular application. See the *SAP2000 Software Verification Manual* for a discussion on the use of this damping coefficient.

## Shear Behavior

For each *shear* deformation degree of freedom you may independently specify either linear or nonlinear behavior.

- If both shear degrees of freedom are nonlinear, the friction and pendulum effects for each shear deformation act in parallel:

$$f_{u2} = f_{u2f} + f_{u2p}$$
$$f_{u3} = f_{u3f} + f_{u3p}$$

The frictional force-deformation relationships are given by:

$$f_{u2f} = -P\,\mu_2\,z_2$$
$$f_{u3f} = -P\,\mu_3\,z_3$$

where $\mu_2$ and $\mu_3$ are friction coefficients, and $z_2$ and $z_3$ are internal hysteretic variables. The friction coefficients are velocity-dependent according to:

$$\mu_2 = \mathbf{fast2} - (\mathbf{fast2} - \mathbf{slow2})\,e^{-r\,v}$$
$$\mu_3 = \mathbf{fast3} - (\mathbf{fast3} - \mathbf{slow3})\,e^{-r\,v}$$

where **slow2** and **slow3** are the friction coefficients at zero velocity, **fast2** and **fast3** are the friction coefficients at fast velocities, $v$ is the resultant velocity of sliding:

$$v = \sqrt{\dot{d}_{u2}^{\,2} + \dot{d}_{u3}^{\,2}}$$

$r$ is an effective inverse velocity given by:

$$r = \frac{\mathbf{rate2}\,\dot{d}_{u2}^{\,2} + \mathbf{rate3}\,\dot{d}_{u3}^{\,2}}{v^2}$$

and **rate2** and **rate3** are the inverses of characteristic sliding velocities. For a Teflon-steel interface the coefficient of friction normally increases with sliding velocity (Nagarajaiah, Reinhorn, and Constantinou, 1991).

The internal hysteretic variables have a range of $\sqrt{z_2^{\,2} + z_3^{\,2}} \le 1$, with the yield surface represented by $\sqrt{z_2^{\,2} + z_3^{\,2}} = 1$. The initial values of $z_2$ and $z_3$ are zero, and they evolve according to the differential equations:

$$\begin{Bmatrix} \dot{z}_2 \\ \dot{z}_3 \end{Bmatrix} = \begin{bmatrix} 1 - a_2\,z_2^{\,2} & -a_3\,z_2\,z_3 \\ -a_2\,z_2\,z_3 & 1 - a_3\,z_3^{\,2} \end{bmatrix} \begin{Bmatrix} \dfrac{\mathbf{k2}}{P\,\mu_2}\,\dot{d}_{u2} \\ \dfrac{\mathbf{k3}}{P\,\mu_3}\,\dot{d}_{u3} \end{Bmatrix}$$

where **k2** and **k3** are the elastic shear stiffnesses of the slider in the absence of sliding, and

$$a_2 = \begin{cases} 1 & \text{if } \dot{d}_{u2}\, z_2 > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$a_3 = \begin{cases} 1 & \text{if } \dot{d}_{u3}\, z_3 > 0 \\ 0 & \text{otherwise} \end{cases}$$

These equations are equivalent to those of Park, Wen and Ang (1986) with $A = 1$ and $\beta = \gamma = 0.5$.

This friction model permits some sliding at all non-zero levels of shear force; the amount of sliding becomes much larger as the shear force approaches the "yield" value of $P\,\mu$. Sliding at lower values of shear force can be minimized by using larger values of the elastic shear stiffnesses.

The pendulum force-deformation relationships are given by:

$$f_{u2p} = -P\,\frac{d_{u2}}{\textbf{radius2}}$$

$$f_{u3p} = -P\,\frac{d_{u3}}{\textbf{radius3}}$$

A zero radius indicates a flat surface, and the corresponding shear force is zero. Normally the radii in the two shear directions will be equal (spherical surface), or one radius will be zero (cylindrical surface). However, it is permitted to specify unequal non-zero radii.

- If only one shear degree of freedom is nonlinear, the above frictional equations reduce to:

$$f_f = -P\,\mu\, z$$

$$\mu = \textbf{fast} - (\textbf{fast} - \textbf{slow})\, e^{-\textbf{rate}\,\dot{d}}$$

$$\dot{z} = \frac{\mathbf{k}}{P\,\mu} \begin{cases} \dot{d}\,(1 - z^2) & \text{if } \dot{d}\, z > 0 \\ \dot{d} & \text{otherwise} \end{cases}$$

The above pendulum equation is unchanged for the nonlinear degree of freedom.

## Linear Behavior

A linear spring relationship applies to the three moment deformations, and to any shear deformation without nonlinear properties. All linear degrees of freedom use

the corresponding effective stiffness, which may be zero. The axial degree of freedom is always nonlinear for nonlinear analyses.

# Double-Acting Friction-Pendulum Isolator Property

This is a biaxial friction-pendulum isolator that supports tension as well as compression, and has uncoupled behavior in the two shear directions. The frictional resistance can be different depending on whether then isolator is in tension or compression. This device consists of two orthogonal, curved rails that are interlocked together. It is intended to provide seismic isolation with uplift prevention, and is described in detail by Roussis and Constantinou [2005].

## Axial Behavior

Independent stiffnesses and gap openings may be specified for tension and compression. The axial force, $f_{u1}$, is *always* nonlinear, and is given by:

$$f_{u1} = P = \begin{cases} \mathbf{k1c}\,(d_{u1} + \mathbf{openc}) & \text{if } (d_{u1} + \mathbf{openc}) < 0 \\ \mathbf{k1t}\,(d_{u1} - \mathbf{opent}) & \text{if } (d_{u1} - \mathbf{opent}) > 0 \\ 0 & \text{otherwise} \end{cases}$$

where **k1c** is the compressive stiffness, **k1t** is the tensile stiffness, **openc** is the gap opening in compression, and **opent** is the gap opening in tension. Each of the four values may be zero or positive.

You may additionally specify a damping coefficient, **c1**, for the axial degree of freedom, in which case the axial force becomes:

$$f_{u1} = P + \mathbf{c1}\,\dot{d}_{u1}$$

The damping force exists whether the isolator is in tension, compression, or is gapping.

Force $f_{u1}$ is the total axial force exerted by the element on the connected joints. However, only the stiffness force $P$ is assumed to act on the bearing surface, causing shear resistance. The damping force is external. See Topic "Friction-Pendulum Isolator Property" (page 248) for a discussion on the use of this damping.

## Shear Behavior

For each shear deformation degree of freedom you may independently specify either linear or nonlinear behavior. The behavior in the two shear directions is uncoupled, although they both depend on the same axial force $P$.

For each nonlinear shear degree of freedom u2 or u3, you independently specify the following parameters:

- Stiffness **k**, representing the elastic behavior before sliding begins. This value is the same for positive or negative $P$.
- Friction coefficients **slowc** and **fastc** for friction under compression at different velocities, and coefficients **slowt** and **fastt** for friction under tension at different velocities.
- Rate parameters **ratec** and **ratet** for friction under compression and tension, respectively. These are the inverses of characteristic sliding velocities. For a Teflon-steel interface the coefficient of friction normally increases with sliding velocity (Nagarajaiah, Reinhorn, and Constantinou, 1991).
- Radius **radius**, which is the same for tension and compression.

Looking at one shear direction, and considering either tension or compression using the appropriate friction parameters, the shear force $f$ is given by:

$$f = f_f + f_p$$

$$f_f = -P\,\mu\,z$$

$$\mu = \mathbf{fast} - (\mathbf{fast} - \mathbf{slow})\,e^{-\mathbf{rate}\,d}$$

$$\dot{z} = \frac{\mathbf{k}}{P\,\mu}\begin{cases}\dot{d}\,(1 - z^2) & \text{if } \dot{d}\,z > 0 \\ \dot{d} & \text{otherwise}\end{cases}$$

$$f_p = -P\,\frac{d}{\mathbf{radius}}$$

where $d$ is the shear deformation and $z$ is an internal hysteretic variable. In the above, the indicators for shear degree of freedom u2 or u3, as well as for tension or compression, have been dropped.

### Linear Behavior

A linear spring relationship applies to the three moment deformations, and to any shear deformation without nonlinear properties. All linear degrees of freedom use the corresponding effective stiffness, which may be zero. The axial degree of freedom is always nonlinear for nonlinear analyses.

## Nonlinear Deformation Loads

A **nonlinear deformation load** is a set of forces and/or moments on the structure that activates a nonlinear internal deformation of an Link/Support element. A nonlinear internal deformation is an Link/Support internal deformation for which nonlinear properties have been specified.

Nonlinear deformation loads are used as starting load vectors for Ritz-vector analysis. Their purpose is to generate Modes that can adequately represent nonlinear behavior when performing nonlinear *modal* time-history analyses. A separate nonlinear deformation load should be used for each nonlinear internal deformation of each Link/Support element.

When requesting a Ritz-vector analysis, you may specify that the program use built-in nonlinear deformation loads, or you may define your own Load Cases for this purpose. In the latter case you may need up to six of these Load Cases per Link/Support element in the model.

The built-in nonlinear deformation loads for a single two-joint Link element are shown in Figure 65 (page 256). Each set of forces and/or moments is self-equilibrating. This tends to localize the effect of the load, usually resulting in a better set of Ritz-vectors. For a single-joint element, only the forces and/or moments acting on joint j are needed.

It is *strongly recommended* that mass or mass moment of inertia be present at each degree of freedom that is acted upon by a force or moment from a nonlinear deformation load. This is needed to generate the appropriate Ritz vectors.

For more information:

- See Topic "Internal Deformations" (page 220) in this Chapter.
- See Topic "Link/Support Properties" (page 222) in this Chapter.
- See Topic "Mass" (page 230) in this Chapter.
- See Topic "Ritz-Vector Analysis" (page 295) in Chapter "Analysis Cases."

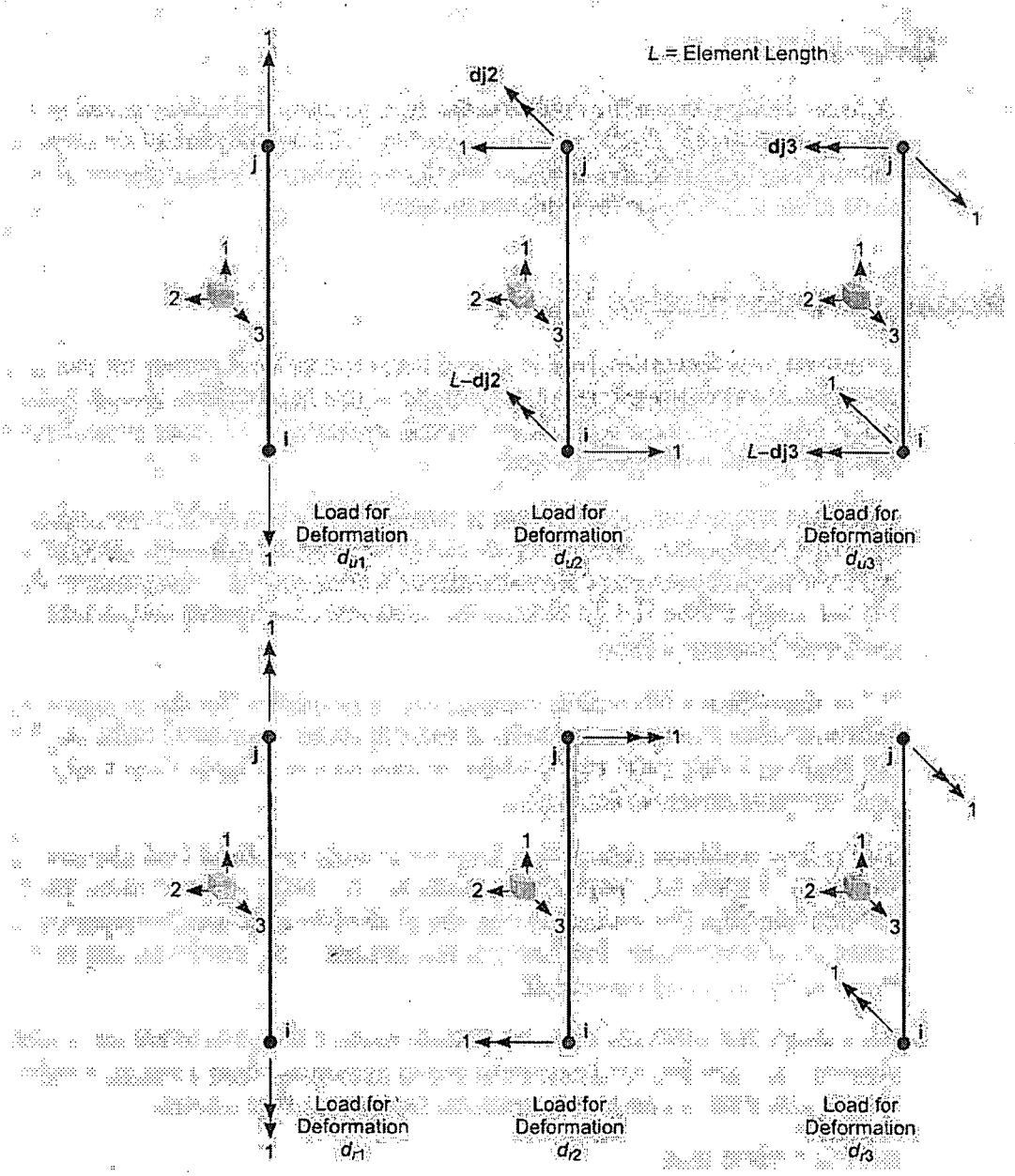


**Figure 65**
*Built-in Nonlinear Deformation Loads for a Two-joint Link Element*

- See Topic "Nonlinear Modal Time-History Analysis (FNA)" (page 295) in Chapter "Analysis Cases."

## Frequency-Dependent Link/Support Properties

Each Link or Support element can have an optional set of frequency-dependent properties assigned to it in addition to the linear/nonlinear property set that must always be assigned. Frequency-dependent properties are only used for frequency-domain types of analyses, such as Steady-State or Power-Spectral-Density analyses.

Frequency-dependent properties represent the complex **impedance** of the element. There is a real part that represents the stiffness and inertial effects, and an imaginary part that represents the hysteretic damping effects. Frequency-dependent properties for the six degrees of freedom of the element may be may be coupled or uncoupled coupled, as given by:

$$\begin{Bmatrix} f_{u1} \\ f_{u2} \\ f_{u3} \\ f_{r1} \\ f_{r2} \\ f_{r3} \end{Bmatrix} = \begin{bmatrix} z_{u1} & z_{u1u2} & z_{u1u3} & z_{u1r1} & z_{u1r2} & z_{u1r3} \\ & z_{u2} & z_{u2u3} & z_{u2r1} & z_{u2r2} & z_{u2r3} \\ & & z_{u3} & z_{u3r1} & z_{u3r2} & z_{u3r3} \\ & & & z_{r1} & z_{r1r2} & z_{r1r3} \\ & sym. & & & z_{r2} & z_{r2r3} \\ & & & & & z_{r3} \end{bmatrix} \begin{Bmatrix} d_{u1} \\ d_{u2} \\ d_{u3} \\ d_{r1} \\ d_{r2} \\ d_{r3} \end{Bmatrix} \qquad \text{(Eqn. 4)}$$

where $z_{u1} = k_{u1} + ic_{u1}$ is the impedance term in the $u1$ degree of freedom, and where $k_{u1}$ is the stiffness/inertial component, $c_{u1}$ is the damping component, and $i$ is the square root of $-1$. The other impedance terms are similar.

In Eqn. (4), the force terms on the left-hand side of the equation and the displacement terms on the right-hand side of the equations are also complex. The real parts of these terms represent the behavior at a phase angle of zero, with time variation given by the cosine function, and the imaginary parts represent behavior at a phase angle of 90°, with time variation given by the sine function.

Each of the 21 impedance terms may vary with frequency. You define the variation for each term as a set of points giving stiffness vs. frequency and damping vs. frequency. It is not unusual for the stiffness term to be negative over part of the range.

A common use for frequency-dependent properties would be in Support elements that represent the far-field radiation-damping effect of the soil region under a rigid foundation.

# CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT P
## FRAME ELEMENT LOAD COMBINATION CHECK
## FOR DRIVE GIRDER – ELEMENTS G01 – G08
## FOR CASE-07, CASE-08, and CASE-09

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| Case-07: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | DL | LinStatic | | 0 | -49 | 0 | 1 | 4 | -4 |
| G01 | 146 | DL | LinStatic | | 0 | -42 | 0 | 1 | 3 | 6,664 |
| G01 | 0 | LL | LinStatic | | 0 | -58 | 0 | 1 | 3 | 0 |
| G01 | 146 | LL | LinStatic | | 0 | -58 | 0 | 1 | 2 | 8,452 |
| G01 | 0 | A1 | NonModHist | Max | 73 | 64 | 9 | 500 | 2,454 | 427 |
| G01 | 146 | A1 | NonModHist | Max | 73 | 64 | 9 | 500 | 1,106 | 9,320 |
| G01 | 0 | A1 | NonModHist | Min | -75 | -63 | -10 | -450 | -2,320 | -474 |
| G01 | 146 | A1 | NonModHist | Min | -75 | -63 | -10 | -450 | -937 | -9,517 |
| G01 | 0 | A2 | NonModHist | Max | 60 | 62 | 10 | 407 | 2,252 | 445 |
| G01 | 146 | A2 | NonModHist | Max | 60 | 62 | 10 | 407 | 922 | 8,324 |
| G01 | 0 | A2 | NonModHist | Min | -71 | -56 | -10 | -428 | -2,273 | -443 |
| G01 | 146 | A2 | NonModHist | Min | -71 | -56 | -10 | -428 | -955 | -8,966 |
| G01 | 0 | A3 | NonModHist | Max | 77 | 63 | 8 | 390 | 1,903 | 557 |
| G01 | 146 | A3 | NonModHist | Max | 77 | 63 | 8 | 390 | 799 | 8,904 |
| G01 | 0 | A3 | NonModHist | Min | -62 | -61 | -10 | -601 | -2,727 | -534 |
| G01 | 146 | A3 | NonModHist | Min | -62 | -61 | -10 | -601 | -1,228 | -9,242 |
| G01 | 0 | A4 | NonModHist | Max | 68 | 59 | 10 | 511 | 2,581 | 432 |
| G01 | 146 | A4 | NonModHist | Max | 68 | 59 | 10 | 511 | 1,174 | 8,681 |
| G01 | 0 | A4 | NonModHist | Min | -94 | -59 | -9 | -443 | -2,147 | -485 |
| G01 | 146 | A4 | NonModHist | Min | -94 | -59 | -9 | -443 | -915 | -8,552 |
| G01 | 0 | A5 | NonModHist | Max | 73 | 70 | 10 | 480 | 2,476 | 538 |
| G01 | 146 | A5 | NonModHist | Max | 73 | 70 | 10 | 480 | 1,073 | 9,858 |
| G01 | 0 | A5 | NonModHist | Min | -66 | -69 | -11 | -530 | -2,704 | -413 |
| G01 | 146 | A5 | NonModHist | Min | -66 | -69 | -11 | -530 | -1,200 | -9,961 |
| G01 | 0 | EQ | Combination | Max | 78 | 64 | 10 | 514 | 2,548 | 500 |
| G01 | 146 | EQ | Combination | Max | 78 | 64 | 10 | 514 | 1,133 | 9,274 |
| G01 | 0 | EQ | Combination | Min | -78 | -64 | -10 | -514 | -2,548 | -500 |
| G01 | 146 | EQ | Combination | Min | -78 | -64 | -10 | -514 | -1,133 | -9,274 |
| G01 | 0 | C07 | Combination | Max | 78 | -43 | 10 | 515 | 2,555 | 496 |
| G01 | 146 | C07 | Combination | Max | 78 | -37 | 10 | 515 | 1,137 | 24,390 |
| G01 | 0 | C07 | Combination | Min | -78 | -171 | -10 | -513 | -2,540 | -504 |
| G01 | 146 | C07 | Combination | Min | -78 | -164 | -10 | -513 | -1,128 | 5,842 |
| **Maximum Absolute for Case A1:** | | | | | **75** | **64** | **10** | **500** | **2,454** | **9,517** |
| **Maximum Absolute for Case A2:** | | | | | **71** | **62** | **10** | **428** | **2,273** | **8,966** |
| **Maximum Absolute for Case A3:** | | | | | **77** | **63** | **10** | **601** | **2,727** | **9,242** |
| **Maximum Absolute for Case A4:** | | | | | **94** | **59** | **10** | **511** | **2,581** | **8,681** |
| **Maximum Absolute for Case A5:** | | | | | **73** | **70** | **11** | **530** | **2,704** | **9,961** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **78** | **64** | **10** | **514** | **2,548** | **9,274** |
| **Maximum Absolute for Case "EQ":** | | | | | **78** | **64** | **10** | **514** | **2,548** | **9,274** |
| **"DL":** | | | | | **0** | **49** | **0** | **1** | **4** | **6,664** |
| **"LL":** | | | | | **0** | **58** | **0** | **1** | **3** | **8,452** |
| **DL+LL+EQ for Element and Case: G01 C07:** | | | | | **78** | **171** | **10** | **515** | **2,555** | **24,390** |

| Case-07: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame Element | Station in | Output Case | Case Type | Step Type | P Kip | V2 Kip | V3 Kip | T Kip-in | M2 Kip-in | M3 Kip-in |
| G02 | 0 | DL | LinStatic | | 0 | -42 | 0 | 1 | 3 | 6,664 |
| G02 | 138 | DL | LinStatic | | 0 | -36 | 0 | 1 | 1 | 12,076 |
| G02 | 0 | LL | LinStatic | | 0 | -58 | 0 | 1 | 2 | 8,452 |
| G02 | 138 | LL | LinStatic | | 0 | -58 | 0 | 1 | 0 | 16,441 |
| G02 | 0 | A1 | NonModHist | Max | 63 | 63 | 12 | 500 | 1,106 | 9,320 |
| G02 | 138 | A1 | NonModHist | Max | 63 | 63 | 12 | 500 | 561 | 17,770 |
| G02 | 0 | A1 | NonModHist | Min | -65 | -61 | -10 | -450 | -937 | -9,517 |
| G02 | 138 | A1 | NonModHist | Min | -65 | -61 | -10 | -450 | -528 | -18,231 |
| G02 | 0 | A2 | NonModHist | Max | 53 | 61 | 10 | 407 | 922 | 8,324 |
| G02 | 138 | A2 | NonModHist | Max | 53 | 61 | 10 | 407 | 631 | 15,882 |
| G02 | 0 | A2 | NonModHist | Min | -63 | -55 | -10 | -428 | -955 | -8,966 |
| G02 | 138 | A2 | NonModHist | Min | -63 | -55 | -10 | -428 | -548 | -17,357 |
| G02 | 0 | A3 | NonModHist | Max | 68 | 61 | 9 | 390 | 799 | 8,904 |
| G02 | 138 | A3 | NonModHist | Max | 68 | 61 | 9 | 390 | 640 | 16,965 |
| G02 | 0 | A3 | NonModHist | Min | -53 | -59 | -13 | -601 | -1,228 | -9,242 |
| G02 | 138 | A3 | NonModHist | Min | -53 | -59 | -13 | -601 | -520 | -17,684 |
| G02 | 0 | A4 | NonModHist | Max | 59 | 58 | 12 | 511 | 1,174 | 8,681 |
| G02 | 138 | A4 | NonModHist | Max | 59 | 58 | 12 | 511 | 559 | 16,601 |
| G02 | 0 | A4 | NonModHist | Min | -83 | -58 | -10 | -443 | -915 | -8,552 |
| G02 | 138 | A4 | NonModHist | Min | -83 | -58 | -10 | -443 | -578 | -16,550 |
| G02 | 0 | A5 | NonModHist | Max | 65 | 69 | 12 | 480 | 1,073 | 9,858 |
| G02 | 138 | A5 | NonModHist | Max | 65 | 69 | 12 | 480 | 615 | 19,332 |
| G02 | 0 | A5 | NonModHist | Min | -60 | -69 | -12 | -530 | -1,200 | -9,961 |
| G02 | 138 | A5 | NonModHist | Min | -60 | -69 | -12 | -530 | -572 | -19,499 |
| G02 | 0 | EQ | Combination | Max | 69 | 63 | 12 | 514 | 1,133 | 9,274 |
| G02 | 138 | EQ | Combination | Max | 69 | 63 | 12 | 514 | 605 | 17,875 |
| G02 | 0 | EQ | Combination | Min | -69 | -63 | -12 | -514 | -1,133 | -9,274 |
| G02 | 138 | EQ | Combination | Min | -69 | -63 | -12 | -514 | -605 | -17,875 |
| G02 | 0 | C07 | Combination | Max | 69 | -38 | 12 | 515 | 1,137 | 24,390 |
| G02 | 138 | C07 | Combination | Max | 69 | -31 | 12 | 515 | 606 | 46,392 |
| G02 | 0 | C07 | Combination | Min | -68 | -163 | -12 | -513 | -1,128 | 5,842 |
| G02 | 138 | C07 | Combination | Min | -68 | -157 | -12 | -513 | -604 | 10,642 |
| **Maximum Absolute for Case A1:** | | | | | **65** | **63** | **12** | **500** | **1,106** | **18,231** |
| **Maximum Absolute for Case A2:** | | | | | **63** | **61** | **10** | **428** | **955** | **17,357** |
| **Maximum Absolute for Case A3:** | | | | | **68** | **61** | **13** | **601** | **1,228** | **17,684** |
| **Maximum Absolute for Case A4:** | | | | | **83** | **58** | **12** | **511** | **1,174** | **16,601** |
| **Maximum Absolute for Case A5:** | | | | | **65** | **69** | **12** | **530** | **1,200** | **19,499** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **69** | **63** | **12** | **514** | **1,133** | **17,875** |
| **Maximum Absolute for Case "EQ":** | | | | | **69** | **63** | **12** | **514** | **1,133** | **17,875** |
| **"DL":** | | | | | **0** | **42** | **0** | **1** | **3** | **12,076** |
| **"LL":** | | | | | **0** | **58** | **0** | **1** | **2** | **16,441** |
| **DL+LL+EQ for Element and Case: G02 C07:** | | | | | **69** | **163** | **12** | **515** | **1,137** | **46,392** |

| Case-07: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G03 | 0 | DL | LinStatic | | 0 | -36 | 0 | 1 | 1 | 12,076 |
| G03 | 174.5 | DL | LinStatic | | 0 | -28 | 0 | 1 | 0 | 17,680 |
| G03 | 0 | LL | LinStatic | | 0 | -58 | 0 | 1 | 0 | 16,441 |
| G03 | 174.5 | LL | LinStatic | | 0 | -58 | 0 | 1 | -2 | 26,543 |
| G03 | 0 | A1 | NonModHist | Max | 53 | 62 | 11 | 500 | 561 | 17,770 |
| G03 | 174.5 | A1 | NonModHist | Max | 53 | 62 | 11 | 500 | 2,136 | 28,083 |
| G03 | 0 | A1 | NonModHist | Min | -58 | -59 | -10 | -450 | -528 | -18,231 |
| G03 | 174.5 | A1 | NonModHist | Min | -58 | -59 | -10 | -450 | -2,459 | -28,988 |
| G03 | 0 | A2 | NonModHist | Max | 46 | 58 | 10 | 407 | 631 | 15,882 |
| G03 | 174.5 | A2 | NonModHist | Max | 46 | 58 | 10 | 407 | 2,125 | 25,093 |
| G03 | 0 | A2 | NonModHist | Min | -53 | -53 | -10 | -428 | -548 | -17,357 |
| G03 | 174.5 | A2 | NonModHist | Min | -53 | -53 | -10 | -428 | -2,069 | -27,520 |
| G03 | 0 | A3 | NonModHist | Max | 56 | 59 | 9 | 390 | 640 | 16,965 |
| G03 | 174.5 | A3 | NonModHist | Max | 56 | 59 | 9 | 390 | 2,960 | 26,566 |
| G03 | 0 | A3 | NonModHist | Min | -45 | -57 | -13 | -601 | -520 | -17,684 |
| G03 | 174.5 | A3 | NonModHist | Min | -45 | -57 | -13 | -601 | -2,008 | -27,845 |
| G03 | 0 | A4 | NonModHist | Max | 50 | 58 | 12 | 511 | 559 | 16,601 |
| G03 | 174.5 | A4 | NonModHist | Max | 50 | 58 | 12 | 511 | 2,190 | 26,519 |
| G03 | 0 | A4 | NonModHist | Min | -71 | -57 | -10 | -443 | -578 | -16,550 |
| G03 | 174.5 | A4 | NonModHist | Min | -71 | -57 | -10 | -443 | -2,557 | -26,380 |
| G03 | 0 | A5 | NonModHist | Max | 56 | 68 | 11 | 480 | 615 | 19,332 |
| G03 | 174.5 | A5 | NonModHist | Max | 56 | 68 | 11 | 480 | 2,505 | 30,986 |
| G03 | 0 | A5 | NonModHist | Min | -53 | -67 | -12 | -530 | -572 | -19,499 |
| G03 | 174.5 | A5 | NonModHist | Min | -53 | -67 | -12 | -530 | -2,438 | -31,315 |
| G03 | 0 | EQ | Combination | Max | 59 | 61 | 12 | 514 | 605 | 17,875 |
| G03 | 174.5 | EQ | Combination | Max | 59 | 61 | 12 | 514 | 2,521 | 28,438 |
| G03 | 0 | EQ | Combination | Min | -59 | -61 | -12 | -514 | -605 | -17,875 |
| G03 | 174.5 | EQ | Combination | Min | -59 | -61 | -12 | -514 | -2,521 | -28,438 |
| G03 | 0 | C07 | Combination | Max | 59 | -33 | 12 | 515 | 606 | 46,392 |
| G03 | 174.5 | C07 | Combination | Max | 59 | -25 | 12 | 515 | 2,519 | 72,661 |
| G03 | 0 | C07 | Combination | Min | -59 | -155 | -12 | -513 | -604 | 10,642 |
| G03 | 174.5 | C07 | Combination | Min | -59 | -147 | -12 | -513 | -2,524 | 15,785 |
| **Maximum Absolute for Case A1:** | | | | | **58** | **62** | **11** | **500** | **2,459** | **28,988** |
| **Maximum Absolute for Case A2:** | | | | | **53** | **58** | **10** | **428** | **2,125** | **27,520** |
| **Maximum Absolute for Case A3:** | | | | | **56** | **59** | **13** | **601** | **2,960** | **27,845** |
| **Maximum Absolute for Case A4:** | | | | | **71** | **58** | **12** | **511** | **2,557** | **26,519** |
| **Maximum Absolute for Case A5:** | | | | | **56** | **68** | **12** | **530** | **2,505** | **31,315** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **59** | **61** | **12** | **514** | **2,521** | **28,438** |
| **Maximum Absolute for Case "EQ":** | | | | | **59** | **61** | **12** | **514** | **2,521** | **28,438** |
| **"DL":** | | | | | **0** | **36** | **0** | **1** | **1** | **17,680** |
| **"LL":** | | | | | **0** | **58** | **0** | **1** | **2** | **26,543** |
| **DL+LL+EQ for Element and Case: G03 C07:** | | | | | **59** | **155** | **12** | **515** | **2,525** | **72,661** |

| Case-07: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G04 | 0 | DL | LinStatic | | 0 | 4 | 0 | -1 | 0 | 17,680 |
| G04 | 36.5 | DL | LinStatic | | 0 | 5 | 0 | -1 | 0 | 17,518 |
| G04 | 0 | LL | LinStatic | | 0 | 5 | 0 | 1 | -2 | 26,543 |
| G04 | 36.5 | LL | LinStatic | | 0 | 5 | 0 | 1 | -3 | 26,375 |
| G04 | 0 | A1 | NonModHist | Max | 48 | 6 | 1 | 126 | 2,136 | 28,317 |
| G04 | 36.5 | A1 | NonModHist | Max | 48 | 6 | 1 | 126 | 2,107 | 28,137 |
| G04 | 0 | A1 | NonModHist | Min | -44 | -6 | -1 | -155 | -2,459 | -29,308 |
| G04 | 36.5 | A1 | NonModHist | Min | -44 | -6 | -1 | -155 | -2,418 | -29,110 |
| G04 | 0 | A2 | NonModHist | Max | 43 | 6 | 2 | 196 | 2,125 | 24,858 |
| G04 | 36.5 | A2 | NonModHist | Max | 43 | 6 | 2 | 196 | 2,064 | 24,686 |
| G04 | 0 | A2 | NonModHist | Min | -44 | -6 | -2 | -149 | -2,069 | -27,391 |
| G04 | 36.5 | A2 | NonModHist | Min | -44 | -6 | -2 | -149 | -2,039 | -27,158 |
| G04 | 0 | A3 | NonModHist | Max | 45 | 7 | 2 | 131 | 2,960 | 26,605 |
| G04 | 36.5 | A3 | NonModHist | Max | 45 | 7 | 2 | 131 | 2,899 | 26,422 |
| G04 | 0 | A3 | NonModHist | Min | -35 | -6 | -1 | -147 | -2,008 | -27,710 |
| G04 | 36.5 | A3 | NonModHist | Min | -35 | -6 | -1 | -147 | -1,956 | -27,482 |
| G04 | 0 | A4 | NonModHist | Max | 41 | 6 | 2 | 113 | 2,190 | 26,751 |
| G04 | 36.5 | A4 | NonModHist | Max | 41 | 6 | 2 | 113 | 2,132 | 26,588 |
| G04 | 0 | A4 | NonModHist | Min | -58 | -7 | -1 | -127 | -2,557 | -26,115 |
| G04 | 36.5 | A4 | NonModHist | Min | -58 | -7 | -1 | -127 | -2,531 | -25,962 |
| G04 | 0 | A5 | NonModHist | Max | 45 | 7 | 1 | 160 | 2,505 | 30,773 |
| G04 | 36.5 | A5 | NonModHist | Max | 45 | 7 | 1 | 160 | 2,459 | 30,541 |
| G04 | 0 | A5 | NonModHist | Min | -44 | -7 | -2 | -143 | -2,438 | -31,101 |
| G04 | 36.5 | A5 | NonModHist | Min | -44 | -7 | -2 | -143 | -2,413 | -30,879 |
| G04 | 0 | EQ | Combination | Max | 48 | 7 | 2 | 157 | 2,521 | 28,452 |
| G04 | 36.5 | EQ | Combination | Max | 48 | 7 | 2 | 157 | 2,474 | 28,243 |
| G04 | 0 | EQ | Combination | Min | -48 | -7 | -2 | -157 | -2,521 | -28,452 |
| G04 | 36.5 | EQ | Combination | Min | -48 | -7 | -2 | -157 | -2,474 | -28,243 |
| G04 | 0 | C07 | Combination | Max | 48 | 15 | 2 | 158 | 2,519 | 72,675 |
| G04 | 36.5 | C07 | Combination | Max | 48 | 16 | 2 | 158 | 2,471 | 72,137 |
| G04 | 0 | C07 | Combination | Min | -48 | 2 | -2 | -156 | -2,524 | 15,771 |
| G04 | 36.5 | C07 | Combination | Min | -48 | 3 | -2 | -156 | -2,477 | 15,650 |
| **Maximum Absolute for Case A1:** | | | | | **48** | **6** | **1** | **155** | **2,459** | **29,308** |
| **Maximum Absolute for Case A2:** | | | | | **44** | **6** | **2** | **196** | **2,125** | **27,391** |
| **Maximum Absolute for Case A3:** | | | | | **45** | **7** | **2** | **147** | **2,960** | **27,710** |
| **Maximum Absolute for Case A4:** | | | | | **58** | **7** | **2** | **127** | **2,557** | **26,751** |
| **Maximum Absolute for Case A5:** | | | | | **45** | **7** | **2** | **160** | **2,505** | **31,101** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **48** | **7** | **2** | **157** | **2,521** | **28,452** |
| **Maximum Absolute for Case "EQ":** | | | | | **48** | **7** | **2** | **157** | **2,521** | **28,452** |
| **"DL":** | | | | | **0** | **5** | **0** | **1** | **0** | **17,680** |
| **"LL":** | | | | | **0** | **5** | **0** | **1** | **3** | **26,543** |
| **DL+LL+EQ for Element and Case: G04 C07:** | | | | | **48** | **16** | **2** | **159** | **2,525** | **72,675** |

| Case-07: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G05 | 0 | DL | LinStatic | | 0 | 5 | 0 | -1 | 0 | 17,518 |
| G05 | 109.5 | DL | LinStatic | | 0 | 10 | 0 | -1 | 2 | 16,671 |
| G05 | 0 | LL | LinStatic | | 0 | 5 | 0 | 1 | -3 | 26,375 |
| G05 | 109.5 | LL | LinStatic | | 0 | 5 | 0 | 1 | -6 | 25,870 |
| G05 | 0 | A1 | NonModHist | Max | 43 | 7 | 2 | 126 | 2,107 | 28,137 |
| G05 | 109.5 | A1 | NonModHist | Max | 43 | 7 | 2 | 126 | 1,913 | 27,469 |
| G05 | 0 | A1 | NonModHist | Min | -40 | -7 | -2 | -155 | -2,418 | -29,110 |
| G05 | 109.5 | A1 | NonModHist | Min | -40 | -7 | -2 | -155 | -2,170 | -28,389 |
| G05 | 0 | A2 | NonModHist | Max | 39 | 7 | 3 | 196 | 2,064 | 24,686 |
| G05 | 109.5 | A2 | NonModHist | Max | 39 | 7 | 3 | 196 | 1,910 | 24,044 |
| G05 | 0 | A2 | NonModHist | Min | -40 | -8 | -2 | -149 | -2,039 | -27,158 |
| G05 | 109.5 | A2 | NonModHist | Min | -40 | -8 | -2 | -149 | -1,844 | -26,319 |
| G05 | 0 | A3 | NonModHist | Max | 40 | 8 | 3 | 131 | 2,899 | 26,422 |
| G05 | 109.5 | A3 | NonModHist | Max | 40 | 8 | 3 | 131 | 2,564 | 25,734 |
| G05 | 0 | A3 | NonModHist | Min | -33 | -7 | -2 | -147 | -1,956 | -27,482 |
| G05 | 109.5 | A3 | NonModHist | Min | -33 | -7 | -2 | -147 | -1,750 | -26,740 |
| G05 | 0 | A4 | NonModHist | Max | 37 | 7 | 3 | 113 | 2,132 | 26,588 |
| G05 | 109.5 | A4 | NonModHist | Max | 37 | 7 | 3 | 113 | 1,867 | 25,984 |
| G05 | 0 | A4 | NonModHist | Min | -53 | -8 | -2 | -127 | -2,531 | -25,962 |
| G05 | 109.5 | A4 | NonModHist | Min | -53 | -8 | -2 | -127 | -2,338 | -25,380 |
| G05 | 0 | A5 | NonModHist | Max | 41 | 8 | 3 | 160 | 2,459 | 30,541 |
| G05 | 109.5 | A5 | NonModHist | Max | 41 | 8 | 3 | 160 | 2,307 | 29,711 |
| G05 | 0 | A5 | NonModHist | Min | -40 | -8 | -3 | -143 | -2,413 | -30,879 |
| G05 | 109.5 | A5 | NonModHist | Min | -40 | -8 | -3 | -143 | -2,213 | -30,068 |
| G05 | 0 | EQ | Combination | Max | 43 | 8 | 3 | 157 | 2,474 | 28,243 |
| G05 | 109.5 | EQ | Combination | Max | 43 | 8 | 3 | 157 | 2,258 | 27,500 |
| G05 | 0 | EQ | Combination | Min | -43 | -8 | -3 | -157 | -2,474 | -28,243 |
| G05 | 109.5 | EQ | Combination | Min | -43 | -8 | -3 | -157 | -2,258 | -27,500 |
| G05 | 0 | C07 | Combination | Max | 43 | 18 | 3 | 158 | 2,471 | 72,137 |
| G05 | 109.5 | C07 | Combination | Max | 43 | 23 | 3 | 158 | 2,253 | 70,042 |
| G05 | 0 | C07 | Combination | Min | -43 | 2 | -3 | -156 | -2,477 | 15,650 |
| G05 | 109.5 | C07 | Combination | Min | -43 | 7 | -3 | -156 | -2,262 | 15,041 |
| **Maximum Absolute for Case A1:** | | | | | **43** | **7** | **2** | **155** | **2,418** | **29,110** |
| **Maximum Absolute for Case A2:** | | | | | **40** | **8** | **3** | **196** | **2,064** | **27,158** |
| **Maximum Absolute for Case A3:** | | | | | **40** | **8** | **3** | **147** | **2,899** | **27,482** |
| **Maximum Absolute for Case A4:** | | | | | **53** | **8** | **3** | **127** | **2,531** | **26,588** |
| **Maximum Absolute for Case A5:** | | | | | **41** | **8** | **3** | **160** | **2,459** | **30,879** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **43** | **8** | **3** | **157** | **2,474** | **28,243** |
| **Maximum Absolute for Case "EQ":** | | | | | **43** | **8** | **3** | **157** | **2,474** | **28,243** |
| **"DL":** | | | | | **0** | **10** | **0** | **1** | **2** | **17,518** |
| **"LL":** | | | | | **0** | **5** | **0** | **1** | **6** | **26,375** |
| **DL+LL+EQ for Element and Case: G05 C07:** | | | | | **43** | **23** | **3** | **159** | **2,482** | **72,137** |

| Case-07: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G06 | 0 | DL | LinStatic | | 0 | 34 | 0 | 0 | 2 | 16,671 |
| G06 | 101.5 | DL | LinStatic | | 0 | 39 | 0 | 0 | 2 | 12,937 |
| G06 | 0 | LL | LinStatic | | 0 | 67 | 0 | -1 | -6 | 25,870 |
| G06 | 101.5 | LL | LinStatic | | 0 | 67 | 0 | -1 | -4 | 19,059 |
| G06 | 0 | A1 | NonModHist | Max | 37 | 68 | 10 | 499 | 1,913 | 27,469 |
| G06 | 101.5 | A1 | NonModHist | Max | 37 | 68 | 10 | 499 | 1,070 | 20,530 |
| G06 | 0 | A1 | NonModHist | Min | -34 | -73 | -11 | -562 | -2,170 | -28,389 |
| G06 | 101.5 | A1 | NonModHist | Min | -34 | -73 | -11 | -562 | -1,122 | -21,011 |
| G06 | 0 | A2 | NonModHist | Max | 34 | 61 | 10 | 487 | 1,910 | 24,044 |
| G06 | 101.5 | A2 | NonModHist | Max | 34 | 61 | 10 | 487 | 1,086 | 18,066 |
| G06 | 0 | A2 | NonModHist | Min | -35 | -68 | -9 | -461 | -1,844 | -26,319 |
| G06 | 101.5 | A2 | NonModHist | Min | -35 | -68 | -9 | -461 | -945 | -19,426 |
| G06 | 0 | A3 | NonModHist | Max | 34 | 65 | 14 | 672 | 2,564 | 25,734 |
| G06 | 101.5 | A3 | NonModHist | Max | 34 | 65 | 14 | 672 | 1,202 | 19,097 |
| G06 | 0 | A3 | NonModHist | Min | -30 | -67 | -9 | -445 | -1,750 | -26,740 |
| G06 | 101.5 | A3 | NonModHist | Min | -30 | -67 | -9 | -445 | -902 | -20,046 |
| G06 | 0 | A4 | NonModHist | Max | 32 | 66 | 10 | 507 | 1,867 | 25,984 |
| G06 | 101.5 | A4 | NonModHist | Max | 32 | 66 | 10 | 507 | 917 | 19,311 |
| G06 | 0 | A4 | NonModHist | Min | -46 | -64 | -11 | -575 | -2,338 | -25,380 |
| G06 | 101.5 | A4 | NonModHist | Min | -46 | -64 | -11 | -575 | -1,197 | -18,937 |
| G06 | 0 | A5 | NonModHist | Max | 34 | 77 | 12 | 598 | 2,307 | 29,711 |
| G06 | 101.5 | A5 | NonModHist | Max | 34 | 77 | 12 | 598 | 1,298 | 21,931 |
| G06 | 0 | A5 | NonModHist | Min | -35 | -77 | -11 | -539 | -2,213 | -30,068 |
| G06 | 101.5 | A5 | NonModHist | Min | -35 | -77 | -11 | -539 | -1,076 | -22,226 |
| G06 | 0 | EQ | Combination | Max | 37 | 70 | 12 | 579 | 2,258 | 27,500 |
| G06 | 101.5 | EQ | Combination | Max | 37 | 70 | 12 | 579 | 1,181 | 20,404 |
| G06 | 0 | EQ | Combination | Min | -37 | -70 | -12 | -579 | -2,258 | -27,500 |
| G06 | 101.5 | EQ | Combination | Min | -37 | -70 | -12 | -579 | -1,181 | -20,404 |
| G06 | 0 | C07 | Combination | Max | 37 | 172 | 12 | 577 | 2,253 | 70,042 |
| G06 | 101.5 | C07 | Combination | Max | 37 | 176 | 12 | 577 | 1,179 | 52,400 |
| G06 | 0 | C07 | Combination | Min | -37 | 31 | -12 | -581 | -2,262 | 15,041 |
| G06 | 101.5 | C07 | Combination | Min | -37 | 36 | -12 | -581 | -1,183 | 11,591 |
| **Maximum Absolute for Case A1:** | | | | | **37** | **73** | **11** | **562** | **2,170** | **28,389** |
| **Maximum Absolute for Case A2:** | | | | | **35** | **68** | **10** | **487** | **1,910** | **26,319** |
| **Maximum Absolute for Case A3:** | | | | | **34** | **67** | **14** | **672** | **2,564** | **26,740** |
| **Maximum Absolute for Case A4:** | | | | | **46** | **66** | **11** | **575** | **2,338** | **25,984** |
| **Maximum Absolute for Case A5:** | | | | | **35** | **77** | **12** | **598** | **2,307** | **30,068** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **37** | **70** | **12** | **579** | **2,258** | **27,500** |
| **Maximum Absolute for Case "EQ":** | | | | | **37** | **70** | **12** | **579** | **2,258** | **27,500** |
| **"DL":** | | | | | **0** | **39** | **0** | **0** | **2** | **16,671** |
| **"LL":** | | | | | **0** | **67** | **0** | **1** | **6** | **25,870** |
| **DL+LL+EQ for Element and Case: G06 C07:** | | | | | **37** | **176** | **12** | **581** | **2,266** | **70,042** |

| Case-07: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G07 | 0 | DL | LinStatic | | 0 | 39 | 0 | 0 | 2 | 12,937 |
| G07 | 138 | DL | LinStatic | | 0 | 45 | 0 | 0 | 3 | 7,108 |
| G07 | 0 | LL | LinStatic | | 0 | 67 | 0 | -1 | -4 | 19,059 |
| G07 | 138 | LL | LinStatic | | 0 | 67 | 0 | -1 | -1 | 9,798 |
| G07 | 0 | A1 | NonModHist | Max | 30 | 70 | 10 | 499 | 1,070 | 20,530 |
| G07 | 138 | A1 | NonModHist | Max | 30 | 70 | 10 | 499 | 575 | 10,885 |
| G07 | 0 | A1 | NonModHist | Min | -28 | -74 | -11 | -562 | -1,122 | -21,011 |
| G07 | 138 | A1 | NonModHist | Min | -28 | -74 | -11 | -562 | -468 | -10,781 |
| G07 | 0 | A2 | NonModHist | Max | 27 | 61 | 10 | 487 | 1,086 | 18,066 |
| G07 | 138 | A2 | NonModHist | Max | 27 | 61 | 10 | 487 | 505 | 9,777 |
| G07 | 0 | A2 | NonModHist | Min | -29 | -69 | -9 | -461 | -945 | -19,426 |
| G07 | 138 | A2 | NonModHist | Min | -29 | -69 | -9 | -461 | -512 | -10,025 |
| G07 | 0 | A3 | NonModHist | Max | 27 | 66 | 13 | 672 | 1,202 | 19,097 |
| G07 | 138 | A3 | NonModHist | Max | 27 | 66 | 13 | 672 | 507 | 9,935 |
| G07 | 0 | A3 | NonModHist | Min | -26 | -68 | -9 | -445 | -902 | -20,046 |
| G07 | 138 | A3 | NonModHist | Min | -26 | -68 | -9 | -445 | -644 | -10,684 |
| G07 | 0 | A4 | NonModHist | Max | 26 | 67 | 10 | 507 | 917 | 19,311 |
| G07 | 138 | A4 | NonModHist | Max | 26 | 67 | 10 | 507 | 511 | 10,244 |
| G07 | 0 | A4 | NonModHist | Min | -37 | -66 | -12 | -575 | -1,197 | -18,937 |
| G07 | 138 | A4 | NonModHist | Min | -37 | -66 | -12 | -575 | -500 | -9,931 |
| G07 | 0 | A5 | NonModHist | Max | 27 | 78 | 12 | 598 | 1,298 | 21,931 |
| G07 | 138 | A5 | NonModHist | Max | 27 | 78 | 12 | 598 | 676 | 11,184 |
| G07 | 0 | A5 | NonModHist | Min | -29 | -79 | -11 | -539 | -1,076 | -22,226 |
| G07 | 138 | A5 | NonModHist | Min | -29 | -79 | -11 | -539 | -583 | -11,351 |
| G07 | 0 | EQ | Combination | Max | 30 | 71 | 11 | 579 | 1,181 | 20,404 |
| G07 | 138 | EQ | Combination | Max | 30 | 71 | 11 | 579 | 584 | 10,638 |
| G07 | 0 | EQ | Combination | Min | -30 | -71 | -11 | -579 | -1,181 | -20,404 |
| G07 | 138 | EQ | Combination | Min | -30 | -71 | -11 | -579 | -584 | -10,638 |
| G07 | 0 | C07 | Combination | Max | 30 | 178 | 11 | 577 | 1,179 | 52,400 |
| G07 | 138 | C07 | Combination | Max | 30 | 184 | 11 | 577 | 586 | 27,544 |
| G07 | 0 | C07 | Combination | Min | -30 | 35 | -12 | -581 | -1,183 | 11,591 |
| G07 | 138 | C07 | Combination | Min | -30 | 41 | -12 | -581 | -581 | 6,268 |
| **Maximum Absolute for Case A1:** | | | | | **30** | **74** | **11** | **562** | **1,122** | **21,011** |
| **Maximum Absolute for Case A2:** | | | | | **29** | **69** | **10** | **487** | **1,086** | **19,426** |
| **Maximum Absolute for Case A3:** | | | | | **27** | **68** | **13** | **672** | **1,202** | **20,046** |
| **Maximum Absolute for Case A4:** | | | | | **37** | **67** | **12** | **575** | **1,197** | **19,311** |
| **Maximum Absolute for Case A5:** | | | | | **29** | **79** | **12** | **598** | **1,298** | **22,226** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **30** | **71** | **11** | **579** | **1,181** | **20,404** |
| **Maximum Absolute for Case "EQ":** | | | | | **30** | **71** | **11** | **579** | **1,181** | **20,404** |
| **"DL":** | | | | | **0** | **45** | **0** | **0** | **3** | **12,937** |
| **"LL":** | | | | | **0** | **67** | **0** | **1** | **4** | **19,059** |
| **DL+LL+EQ for Element and Case: G07 C07:** | | | | | **30** | **184** | **12** | **581** | **1,188** | **52,400** |

| Case-07: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G08 | 0 | DL | LinStatic | | 0 | 45 | 0 | 0 | 3 | 7,108 |
| G08 | 146 | DL | LinStatic | | 0 | 52 | 0 | 0 | 4 | -1 |
| G08 | 0 | LL | LinStatic | | 0 | 67 | 0 | -1 | -1 | 9,798 |
| G08 | 146 | LL | LinStatic | | 0 | 67 | 0 | -1 | 2 | 0 |
| G08 | 0 | A1 | NonModHist | Max | 22 | 71 | 9 | 499 | 575 | 10,885 |
| G08 | 146 | A1 | NonModHist | Max | 22 | 71 | 9 | 499 | 1,754 | 721 |
| G08 | 0 | A1 | NonModHist | Min | -20 | -75 | -9 | -562 | -468 | -10,781 |
| G08 | 146 | A1 | NonModHist | Min | -20 | -75 | -9 | -562 | -1,617 | -705 |
| G08 | 0 | A2 | NonModHist | Max | 19 | 63 | 10 | 487 | 505 | 9,777 |
| G08 | 146 | A2 | NonModHist | Max | 19 | 63 | 10 | 487 | 1,504 | 726 |
| G08 | 0 | A2 | NonModHist | Min | -22 | -69 | -8 | -461 | -512 | -10,025 |
| G08 | 146 | A2 | NonModHist | Min | -22 | -69 | -8 | -461 | -1,664 | -617 |
| G08 | 0 | A3 | NonModHist | Max | 19 | 68 | 10 | 672 | 507 | 9,935 |
| G08 | 146 | A3 | NonModHist | Max | 19 | 68 | 10 | 672 | 1,558 | 831 |
| G08 | 0 | A3 | NonModHist | Min | -21 | -70 | -8 | -445 | -644 | -10,684 |
| G08 | 146 | A3 | NonModHist | Min | -21 | -70 | -8 | -445 | -2,158 | -670 |
| G08 | 0 | A4 | NonModHist | Max | 21 | 68 | 8 | 507 | 511 | 10,244 |
| G08 | 146 | A4 | NonModHist | Max | 21 | 68 | 8 | 507 | 1,855 | 800 |
| G08 | 0 | A4 | NonModHist | Min | -27 | -68 | -10 | -575 | -500 | -9,931 |
| G08 | 146 | A4 | NonModHist | Min | -27 | -68 | -10 | -575 | -1,570 | -789 |
| G08 | 0 | A5 | NonModHist | Max | 20 | 79 | 11 | 598 | 676 | 11,184 |
| G08 | 146 | A5 | NonModHist | Max | 20 | 79 | 11 | 598 | 1,737 | 818 |
| G08 | 0 | A5 | NonModHist | Min | -22 | -79 | -9 | -539 | -583 | -11,351 |
| G08 | 146 | A5 | NonModHist | Min | -22 | -79 | -9 | -539 | -1,894 | -746 |
| G08 | 0 | EQ | Combination | Max | 23 | 72 | 10 | 579 | 584 | 10,638 |
| G08 | 146 | EQ | Combination | Max | 23 | 72 | 10 | 579 | 1,865 | 779 |
| G08 | 0 | EQ | Combination | Min | -23 | -72 | -10 | -579 | -584 | -10,638 |
| G08 | 146 | EQ | Combination | Min | -23 | -72 | -10 | -579 | -1,865 | -779 |
| G08 | 0 | C07 | Combination | Max | 23 | 185 | 10 | 577 | 586 | 27,544 |
| G08 | 146 | C07 | Combination | Max | 23 | 191 | 10 | 577 | 1,872 | 778 |
| G08 | 0 | C07 | Combination | Min | -23 | 40 | -10 | -581 | -581 | 6,268 |
| G08 | 146 | C07 | Combination | Min | -23 | 47 | -10 | -581 | -1,859 | -781 |
| **Maximum Absolute for Case A1:** | | | | | **22** | **75** | **9** | **562** | **1,754** | **10,885** |
| **Maximum Absolute for Case A2:** | | | | | **22** | **69** | **10** | **487** | **1,664** | **10,025** |
| **Maximum Absolute for Case A3:** | | | | | **21** | **70** | **10** | **672** | **2,158** | **10,684** |
| **Maximum Absolute for Case A4:** | | | | | **27** | **68** | **10** | **575** | **1,855** | **10,244** |
| **Maximum Absolute for Case A5:** | | | | | **22** | **79** | **11** | **598** | **1,894** | **11,351** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **23** | **72** | **10** | **579** | **1,865** | **10,638** |
| **Maximum Absolute for Case "EQ":** | | | | | **23** | **72** | **10** | **579** | **1,865** | **10,638** |
| **"DL":** | | | | | **0** | **52** | **0** | **0** | **4** | **7,108** |
| **"LL":** | | | | | **0** | **67** | **0** | **1** | **2** | **9,798** |
| **DL+LL+EQ for Element and Case: G08 C07:** | | | | | **23** | **191** | **10** | **581** | **1,872** | **27,544** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | DL | LinStatic | | 0 | -35 | 0 | 0 | 2 | -3 |
| G01 | 146 | DL | LinStatic | | 0 | -28 | 0 | 0 | 2 | 4,587 |
| G01 | 0 | LL | LinStatic | | 0 | -27 | 0 | 1 | 1 | 0 |
| G01 | 146 | LL | LinStatic | | 0 | -27 | 0 | 1 | 1 | 3,890 |
| G01 | 0 | A1 | NonModHist | Max | 75 | 28 | 7 | 136 | 2,264 | 366 |
| G01 | 146 | A1 | NonModHist | Max | 75 | 28 | 7 | 136 | 1,552 | 3,763 |
| G01 | 0 | A1 | NonModHist | Min | -67 | -27 | -6 | -129 | -2,243 | -531 |
| G01 | 146 | A1 | NonModHist | Min | -67 | -27 | -6 | -129 | -1,699 | -3,981 |
| G01 | 0 | A2 | NonModHist | Max | 65 | 22 | 8 | 132 | 2,400 | 532 |
| G01 | 146 | A2 | NonModHist | Max | 65 | 22 | 8 | 132 | 2,019 | 3,202 |
| G01 | 0 | A2 | NonModHist | Min | -74 | -23 | -7 | -129 | -2,299 | -408 |
| G01 | 146 | A2 | NonModHist | Min | -74 | -23 | -7 | -129 | -1,810 | -3,543 |
| G01 | 0 | A3 | NonModHist | Max | 85 | 24 | 7 | 121 | 2,321 | 527 |
| G01 | 146 | A3 | NonModHist | Max | 85 | 24 | 7 | 121 | 1,897 | 3,612 |
| G01 | 0 | A3 | NonModHist | Min | -71 | -25 | -7 | -133 | -1,930 | -549 |
| G01 | 146 | A3 | NonModHist | Min | -71 | -25 | -7 | -133 | -1,485 | -3,828 |
| G01 | 0 | A4 | NonModHist | Max | 70 | 24 | 7 | 131 | 2,297 | 464 |
| G01 | 146 | A4 | NonModHist | Max | 70 | 24 | 7 | 131 | 1,772 | 3,822 |
| G01 | 0 | A4 | NonModHist | Min | -92 | -26 | -7 | -135 | -2,507 | -482 |
| G01 | 146 | A4 | NonModHist | Min | -92 | -26 | -7 | -135 | -1,986 | -3,620 |
| G01 | 0 | A5 | NonModHist | Max | 72 | 29 | 7 | 151 | 2,704 | 534 |
| G01 | 146 | A5 | NonModHist | Max | 72 | 29 | 7 | 151 | 2,435 | 3,833 |
| G01 | 0 | A5 | NonModHist | Min | -67 | -24 | -7 | -144 | -2,229 | -634 |
| G01 | 146 | A5 | NonModHist | Min | -67 | -24 | -7 | -144 | -1,860 | -4,162 |
| G01 | 0 | EQ | Combination | Max | 79 | 26 | 7 | 137 | 2,439 | 546 |
| G01 | 146 | EQ | Combination | Max | 79 | 26 | 7 | 137 | 2,007 | 3,867 |
| G01 | 0 | EQ | Combination | Min | -79 | -26 | -7 | -137 | -2,439 | -546 |
| G01 | 146 | EQ | Combination | Min | -79 | -26 | -7 | -137 | -2,007 | -3,867 |
| G01 | 0 | C08 | Combination | Max | 80 | -35 | 7 | 138 | 2,442 | 543 |
| G01 | 146 | C08 | Combination | Max | 80 | -28 | 7 | 138 | 2,009 | 12,344 |
| G01 | 0 | C08 | Combination | Min | -79 | -88 | -7 | -136 | -2,436 | -548 |
| G01 | 146 | C08 | Combination | Min | -79 | -81 | -7 | -136 | -2,005 | 4,610 |
| **Maximum Absolute for Case A1:** | | | | | **75** | **28** | **7** | **136** | **2,264** | **3,981** |
| **Maximum Absolute for Case A2:** | | | | | **74** | **23** | **8** | **132** | **2,400** | **3,543** |
| **Maximum Absolute for Case A3:** | | | | | **85** | **25** | **7** | **133** | **2,321** | **3,828** |
| **Maximum Absolute for Case A4:** | | | | | **92** | **26** | **7** | **135** | **2,507** | **3,822** |
| **Maximum Absolute for Case A5:** | | | | | **72** | **29** | **7** | **151** | **2,704** | **4,162** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **79** | **26** | **7** | **137** | **2,439** | **3,867** |
| **Maximum Absolute for Case "EQ":** | | | | | **79** | **26** | **7** | **137** | **2,439** | **3,867** |
| **"DL":** | | | | | **0** | **35** | **0** | **0** | **2** | **4,587** |
| **"LL":** | | | | | **0** | **27** | **0** | **1** | **1** | **3,890** |
| **DL+LL+EQ for Element and Case: G01 C08:** | | | | | **80** | **88** | **7** | **138** | **2,442** | **12,344** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G02 | 0 | DL | LinStatic | | 0 | -28 | 0 | 0 | 2 | 4,587 |
| G02 | 138 | DL | LinStatic | | 0 | -22 | 0 | 0 | 1 | 8,035 |
| G02 | 0 | LL | LinStatic | | 0 | -27 | 0 | 1 | 1 | 3,890 |
| G02 | 138 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 7,566 |
| G02 | 0 | A1 | NonModHist | Max | 67 | 24 | 8 | 136 | 1,552 | 3,763 |
| G02 | 138 | A1 | NonModHist | Max | 67 | 24 | 8 | 136 | 1,294 | 7,085 |
| G02 | 0 | A1 | NonModHist | Min | -63 | -24 | -6 | -129 | -1,699 | -3,981 |
| G02 | 138 | A1 | NonModHist | Min | -63 | -24 | -6 | -129 | -1,600 | -7,339 |
| G02 | 0 | A2 | NonModHist | Max | 59 | 22 | 7 | 132 | 2,019 | 3,202 |
| G02 | 138 | A2 | NonModHist | Max | 59 | 22 | 7 | 132 | 1,649 | 5,918 |
| G02 | 0 | A2 | NonModHist | Min | -66 | -21 | -6 | -129 | -1,810 | -3,543 |
| G02 | 138 | A2 | NonModHist | Min | -66 | -21 | -6 | -129 | -1,444 | -6,453 |
| G02 | 0 | A3 | NonModHist | Max | 75 | 24 | 7 | 121 | 1,897 | 3,612 |
| G02 | 138 | A3 | NonModHist | Max | 75 | 24 | 7 | 121 | 1,690 | 6,720 |
| G02 | 0 | A3 | NonModHist | Min | -62 | -23 | -7 | -133 | -1,485 | -3,828 |
| G02 | 138 | A3 | NonModHist | Min | -62 | -23 | -7 | -133 | -1,312 | -6,915 |
| G02 | 0 | A4 | NonModHist | Max | 63 | 23 | 7 | 131 | 1,772 | 3,822 |
| G02 | 138 | A4 | NonModHist | Max | 63 | 23 | 7 | 131 | 1,501 | 7,051 |
| G02 | 0 | A4 | NonModHist | Min | -83 | -24 | -7 | -135 | -1,986 | -3,620 |
| G02 | 138 | A4 | NonModHist | Min | -83 | -24 | -7 | -135 | -1,619 | -6,602 |
| G02 | 0 | A5 | NonModHist | Max | 65 | 26 | 7 | 151 | 2,435 | 3,833 |
| G02 | 138 | A5 | NonModHist | Max | 65 | 26 | 7 | 151 | 1,939 | 6,785 |
| G02 | 0 | A5 | NonModHist | Min | -65 | -23 | -6 | -144 | -1,860 | -4,162 |
| G02 | 138 | A5 | NonModHist | Min | -65 | -23 | -6 | -144 | -1,664 | -7,731 |
| G02 | 0 | EQ | Combination | Max | 71 | 24 | 7 | 137 | 2,007 | 3,867 |
| G02 | 138 | EQ | Combination | Max | 71 | 24 | 7 | 137 | 1,699 | 7,098 |
| G02 | 0 | EQ | Combination | Min | -71 | -24 | -7 | -137 | -2,007 | -3,867 |
| G02 | 138 | EQ | Combination | Min | -71 | -24 | -7 | -137 | -1,699 | -7,098 |
| G02 | 0 | C08 | Combination | Max | 71 | -31 | 7 | 138 | 2,009 | 12,344 |
| G02 | 138 | C08 | Combination | Max | 71 | -25 | 7 | 138 | 1,701 | 22,699 |
| G02 | 0 | C08 | Combination | Min | -71 | -79 | -7 | -136 | -2,005 | 4,610 |
| G02 | 138 | C08 | Combination | Min | -71 | -72 | -7 | -136 | -1,698 | 8,503 |
| **Maximum Absolute for Case A1:** | | | | | **67** | **24** | **8** | **136** | **1,699** | **7,339** |
| **Maximum Absolute for Case A2:** | | | | | **66** | **22** | **7** | **132** | **2,019** | **6,453** |
| **Maximum Absolute for Case A3:** | | | | | **75** | **24** | **7** | **133** | **1,897** | **6,915** |
| **Maximum Absolute for Case A4:** | | | | | **83** | **24** | **7** | **135** | **1,986** | **7,051** |
| **Maximum Absolute for Case A5:** | | | | | **65** | **26** | **7** | **151** | **2,435** | **7,731** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **71** | **24** | **7** | **137** | **2,007** | **7,098** |
| **Maximum Absolute for Case "EQ":** | | | | | **71** | **24** | **7** | **137** | **2,007** | **7,098** |
| **"DL":** | | | | | **0** | **28** | **0** | **0** | **2** | **8,035** |
| **"LL":** | | | | | **0** | **27** | **0** | **1** | **1** | **7,566** |
| **DL+LL+EQ for Element and Case: G02 C08:** | | | | | **71** | **79** | **7** | **138** | **2,009** | **22,699** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G03 | 0 | DL | LinStatic | | 0 | -22 | 0 | 0 | 1 | 8,035 |
| G03 | 174.5 | DL | LinStatic | | 0 | -14 | 0 | 0 | 1 | 11,155 |
| G03 | 0 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 7,566 |
| G03 | 174.5 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 12,215 |
| G03 | 0 | A1 | NonModHist | Max | 58 | 22 | 7 | 136 | 1,294 | 7,085 |
| G03 | 174.5 | A1 | NonModHist | Max | 58 | 22 | 7 | 136 | 1,050 | 10,801 |
| G03 | 0 | A1 | NonModHist | Min | -58 | -23 | -6 | -129 | -1,600 | -7,339 |
| G03 | 174.5 | A1 | NonModHist | Min | -58 | -23 | -6 | -129 | -1,214 | -10,897 |
| G03 | 0 | A2 | NonModHist | Max | 53 | 21 | 6 | 132 | 1,649 | 5,918 |
| G03 | 174.5 | A2 | NonModHist | Max | 53 | 21 | 6 | 132 | 1,112 | 9,120 |
| G03 | 0 | A2 | NonModHist | Min | -57 | -20 | -6 | -129 | -1,444 | -6,453 |
| G03 | 174.5 | A2 | NonModHist | Min | -57 | -20 | -6 | -129 | -1,280 | -10,048 |
| G03 | 0 | A3 | NonModHist | Max | 63 | 24 | 7 | 121 | 1,690 | 6,720 |
| G03 | 174.5 | A3 | NonModHist | Max | 63 | 24 | 7 | 121 | 1,248 | 10,226 |
| G03 | 0 | A3 | NonModHist | Min | -53 | -21 | -6 | -133 | -1,312 | -6,915 |
| G03 | 174.5 | A3 | NonModHist | Min | -53 | -21 | -6 | -133 | -1,159 | -10,908 |
| G03 | 0 | A4 | NonModHist | Max | 55 | 22 | 7 | 131 | 1,501 | 7,051 |
| G03 | 174.5 | A4 | NonModHist | Max | 55 | 22 | 7 | 131 | 1,514 | 10,667 |
| G03 | 0 | A4 | NonModHist | Min | -72 | -21 | -7 | -135 | -1,619 | -6,602 |
| G03 | 174.5 | A4 | NonModHist | Min | -72 | -21 | -7 | -135 | -1,095 | -10,128 |
| G03 | 0 | A5 | NonModHist | Max | 57 | 24 | 8 | 151 | 1,939 | 6,785 |
| G03 | 174.5 | A5 | NonModHist | Max | 57 | 24 | 8 | 151 | 1,232 | 10,663 |
| G03 | 0 | A5 | NonModHist | Min | -61 | -23 | -7 | -144 | -1,664 | -7,731 |
| G03 | 174.5 | A5 | NonModHist | Min | -61 | -23 | -7 | -144 | -1,166 | -11,478 |
| G03 | 0 | EQ | Combination | Max | 62 | 23 | 7 | 137 | 1,699 | 7,098 |
| G03 | 174.5 | EQ | Combination | Max | 62 | 23 | 7 | 137 | 1,298 | 10,800 |
| G03 | 0 | EQ | Combination | Min | -62 | -23 | -7 | -137 | -1,699 | -7,098 |
| G03 | 174.5 | EQ | Combination | Min | -62 | -23 | -7 | -137 | -1,298 | -10,800 |
| G03 | 0 | C08 | Combination | Max | 62 | -26 | 7 | 138 | 1,701 | 22,699 |
| G03 | 174.5 | C08 | Combination | Max | 62 | -18 | 7 | 138 | 1,299 | 34,169 |
| G03 | 0 | C08 | Combination | Min | -62 | -71 | -7 | -136 | -1,698 | 8,503 |
| G03 | 174.5 | C08 | Combination | Min | -62 | -63 | -7 | -136 | -1,297 | 12,570 |
| **Maximum Absolute for Case A1:** | | | | | **58** | **23** | **7** | **136** | **1,600** | **10,897** |
| **Maximum Absolute for Case A2:** | | | | | **57** | **21** | **6** | **132** | **1,649** | **10,048** |
| **Maximum Absolute for Case A3:** | | | | | **63** | **24** | **7** | **133** | **1,690** | **10,908** |
| **Maximum Absolute for Case A4:** | | | | | **72** | **22** | **7** | **135** | **1,619** | **10,667** |
| **Maximum Absolute for Case A5:** | | | | | **61** | **24** | **8** | **151** | **1,939** | **11,478** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **62** | **23** | **7** | **137** | **1,699** | **10,800** |
| **Maximum Absolute for Case "EQ":** | | | | | **62** | **23** | **7** | **137** | **1,699** | **10,800** |
| **"DL":** | | | | | **0** | **22** | **0** | **0** | **1** | **11,155** |
| **"LL":** | | | | | **0** | **27** | **0** | **1** | **0** | **12,215** |
| **DL+LL+EQ for Element and Case: G03 C08:** | | | | | **62** | **71** | **7** | **138** | **1,701** | **34,169** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G04 | 0 | DL | LinStatic | | 0 | -14 | 0 | 0 | 1 | 11,155 |
| G04 | 36.5 | DL | LinStatic | | 0 | -12 | 0 | 0 | 1 | 11,632 |
| G04 | 0 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 12,215 |
| G04 | 36.5 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 13,188 |
| G04 | 0 | A1 | NonModHist | Max | 51 | 22 | 6 | 136 | 1,050 | 10,801 |
| G04 | 36.5 | A1 | NonModHist | Max | 51 | 22 | 6 | 136 | 1,001 | 11,553 |
| G04 | 0 | A1 | NonModHist | Min | -54 | -23 | -7 | -129 | -1,214 | -10,897 |
| G04 | 36.5 | A1 | NonModHist | Min | -54 | -23 | -7 | -129 | -1,221 | -11,556 |
| G04 | 0 | A2 | NonModHist | Max | 49 | 20 | 7 | 132 | 1,112 | 9,120 |
| G04 | 36.5 | A2 | NonModHist | Max | 49 | 20 | 7 | 132 | 1,096 | 9,830 |
| G04 | 0 | A2 | NonModHist | Min | -52 | -21 | -7 | -129 | -1,280 | -10,048 |
| G04 | 36.5 | A2 | NonModHist | Min | -52 | -21 | -7 | -129 | -1,232 | -10,793 |
| G04 | 0 | A3 | NonModHist | Max | 55 | 24 | 7 | 121 | 1,248 | 10,226 |
| G04 | 36.5 | A3 | NonModHist | Max | 55 | 24 | 7 | 121 | 1,146 | 10,893 |
| G04 | 0 | A3 | NonModHist | Min | -46 | -20 | -6 | -133 | -1,159 | -10,908 |
| G04 | 36.5 | A3 | NonModHist | Min | -46 | -20 | -6 | -133 | -1,101 | -11,760 |
| G04 | 0 | A4 | NonModHist | Max | 49 | 21 | 6 | 131 | 1,514 | 10,667 |
| G04 | 36.5 | A4 | NonModHist | Max | 49 | 21 | 6 | 131 | 1,423 | 11,357 |
| G04 | 0 | A4 | NonModHist | Min | -63 | -21 | -8 | -135 | -1,095 | -10,128 |
| G04 | 36.5 | A4 | NonModHist | Min | -63 | -21 | -8 | -135 | -978 | -10,846 |
| G04 | 0 | A5 | NonModHist | Max | 53 | 24 | 8 | 151 | 1,232 | 10,663 |
| G04 | 36.5 | A5 | NonModHist | Max | 53 | 24 | 8 | 151 | 1,197 | 11,489 |
| G04 | 0 | A5 | NonModHist | Min | -58 | -23 | -8 | -144 | -1,166 | -11,478 |
| G04 | 36.5 | A5 | NonModHist | Min | -58 | -23 | -8 | -144 | -1,155 | -12,193 |
| G04 | 0 | EQ | Combination | Max | 56 | 23 | 7 | 137 | 1,298 | 10,800 |
| G04 | 36.5 | EQ | Combination | Max | 56 | 23 | 7 | 137 | 1,244 | 11,532 |
| G04 | 0 | EQ | Combination | Min | -56 | -23 | -7 | -137 | -1,298 | -10,800 |
| G04 | 36.5 | EQ | Combination | Min | -56 | -23 | -7 | -137 | -1,244 | -11,532 |
| G04 | 0 | C08 | Combination | Max | 56 | -18 | 7 | 138 | 1,299 | 34,169 |
| G04 | 36.5 | C08 | Combination | Max | 56 | -16 | 7 | 138 | 1,244 | 36,352 |
| G04 | 0 | C08 | Combination | Min | -56 | -63 | -7 | -136 | -1,297 | 12,570 |
| G04 | 36.5 | C08 | Combination | Min | -56 | -61 | -7 | -136 | -1,243 | 13,288 |
| **Maximum Absolute for Case A1:** | | | | | **54** | **23** | **7** | **136** | **1,221** | **11,556** |
| **Maximum Absolute for Case A2:** | | | | | **52** | **21** | **7** | **132** | **1,280** | **10,793** |
| **Maximum Absolute for Case A3:** | | | | | **55** | **24** | **7** | **133** | **1,248** | **11,760** |
| **Maximum Absolute for Case A4:** | | | | | **63** | **21** | **8** | **135** | **1,514** | **11,357** |
| **Maximum Absolute for Case A5:** | | | | | **58** | **24** | **8** | **151** | **1,232** | **12,193** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **56** | **23** | **7** | **137** | **1,299** | **11,532** |
| **Maximum Absolute for Case "EQ":** | | | | | **56** | **23** | **7** | **137** | **1,298** | **11,532** |
| **"DL":** | | | | | **0** | **14** | **0** | **0** | **1** | **11,632** |
| **"LL":** | | | | | **0** | **27** | **0** | **1** | **0** | **13,188** |
| **DL+LL+EQ for Element and Case: G04 C08:** | | | | | **56** | **63** | **7** | **138** | **1,299** | **36,352** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G05 | 0 | DL | LinStatic | | 0 | -12 | 0 | 0 | 1 | 11,632 |
| G05 | 138 | DL | LinStatic | | 0 | -6 | 0 | 0 | 0 | 12,891 |
| G05 | 0 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 13,188 |
| G05 | 138 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 16,864 |
| G05 | 0 | A1 | NonModHist | Max | 45 | 22 | 7 | 136 | 1,001 | 11,553 |
| G05 | 138 | A1 | NonModHist | Max | 45 | 22 | 7 | 136 | 1,165 | 14,322 |
| G05 | 0 | A1 | NonModHist | Min | -51 | -23 | -8 | -129 | -1,221 | -11,556 |
| G05 | 138 | A1 | NonModHist | Min | -51 | -23 | -8 | -129 | -1,419 | -13,928 |
| G05 | 0 | A2 | NonModHist | Max | 45 | 20 | 9 | 132 | 1,096 | 9,830 |
| G05 | 138 | A2 | NonModHist | Max | 45 | 20 | 9 | 132 | 1,104 | 12,473 |
| G05 | 0 | A2 | NonModHist | Min | -47 | -23 | -8 | -129 | -1,232 | -10,793 |
| G05 | 138 | A2 | NonModHist | Min | -47 | -23 | -8 | -129 | -1,119 | -13,507 |
| G05 | 0 | A3 | NonModHist | Max | 49 | 24 | 9 | 121 | 1,146 | 10,893 |
| G05 | 138 | A3 | NonModHist | Max | 49 | 24 | 9 | 121 | 1,218 | 13,384 |
| G05 | 0 | A3 | NonModHist | Min | -40 | -19 | -7 | -133 | -1,101 | -11,760 |
| G05 | 138 | A3 | NonModHist | Min | -40 | -19 | -7 | -133 | -1,175 | -14,892 |
| G05 | 0 | A4 | NonModHist | Max | 43 | 22 | 7 | 131 | 1,423 | 11,357 |
| G05 | 138 | A4 | NonModHist | Max | 43 | 22 | 7 | 131 | 1,135 | 13,878 |
| G05 | 0 | A4 | NonModHist | Min | -56 | -21 | -8 | -135 | -978 | -10,846 |
| G05 | 138 | A4 | NonModHist | Min | -56 | -21 | -8 | -135 | -1,217 | -13,551 |
| G05 | 0 | A5 | NonModHist | Max | 49 | 24 | 9 | 151 | 1,197 | 11,489 |
| G05 | 138 | A5 | NonModHist | Max | 49 | 24 | 9 | 151 | 1,287 | 14,548 |
| G05 | 0 | A5 | NonModHist | Min | -55 | -22 | -9 | -144 | -1,155 | -12,193 |
| G05 | 138 | A5 | NonModHist | Min | -55 | -22 | -9 | -144 | -1,199 | -15,016 |
| G05 | 0 | EQ | Combination | Max | 51 | 23 | 9 | 137 | 1,244 | 11,532 |
| G05 | 138 | EQ | Combination | Max | 51 | 23 | 9 | 137 | 1,252 | 14,323 |
| G05 | 0 | EQ | Combination | Min | -51 | -23 | -9 | -137 | -1,244 | -11,532 |
| G05 | 138 | EQ | Combination | Min | -51 | -23 | -9 | -137 | -1,252 | -14,323 |
| G05 | 0 | C08 | Combination | Max | 51 | -16 | 9 | 138 | 1,244 | 36,352 |
| G05 | 138 | C08 | Combination | Max | 51 | -10 | 9 | 138 | 1,252 | 44,078 |
| G05 | 0 | C08 | Combination | Min | -51 | -62 | -9 | -136 | -1,243 | 13,288 |
| G05 | 138 | C08 | Combination | Min | -51 | -56 | -9 | -136 | -1,252 | 15,432 |
| **Maximum Absolute for Case A1:** | | | | | **51** | **23** | **8** | **136** | **1,419** | **14,322** |
| **Maximum Absolute for Case A2:** | | | | | **47** | **23** | **9** | **132** | **1,232** | **13,507** |
| **Maximum Absolute for Case A3:** | | | | | **49** | **24** | **9** | **133** | **1,218** | **14,892** |
| **Maximum Absolute for Case A4:** | | | | | **56** | **22** | **8** | **135** | **1,423** | **13,878** |
| **Maximum Absolute for Case A5:** | | | | | **55** | **24** | **9** | **151** | **1,287** | **15,016** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **51** | **23** | **9** | **137** | **1,316** | **14,323** |
| **Maximum Absolute for Case "EQ":** | | | | | **51** | **23** | **9** | **137** | **1,252** | **14,323** |
| **"DL":** | | | | | **0** | **12** | **0** | **0** | **1** | **12,891** |
| **"LL":** | | | | | **0** | **27** | **0** | **1** | **0** | **16,864** |
| **DL+LL+EQ for Element and Case: G05 C08:** | | | | | **51** | **62** | **9** | **138** | **1,253** | **44,078** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G06 | 0 | DL | LinStatic | | 0 | -6 | 0 | 0 | 0 | 12,891 |
| G06 | 73 | DL | LinStatic | | 0 | -3 | 0 | 0 | 0 | 13,206 |
| G06 | 0 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 16,864 |
| G06 | 73 | LL | LinStatic | | 0 | -27 | 0 | 1 | 0 | 18,809 |
| G06 | 0 | A1 | NonModHist | Max | 37 | 21 | 8 | 136 | 1,165 | 14,322 |
| G06 | 73 | A1 | NonModHist | Max | 37 | 21 | 8 | 136 | 1,351 | 15,680 |
| G06 | 0 | A1 | NonModHist | Min | -45 | -23 | -9 | -129 | -1,419 | -13,928 |
| G06 | 73 | A1 | NonModHist | Min | -45 | -23 | -9 | -129 | -1,541 | -15,290 |
| G06 | 0 | A2 | NonModHist | Max | 40 | 19 | 9 | 132 | 1,104 | 12,473 |
| G06 | 73 | A2 | NonModHist | Max | 40 | 19 | 9 | 132 | 1,428 | 13,878 |
| G06 | 0 | A2 | NonModHist | Min | -41 | -23 | -8 | -129 | -1,119 | -13,507 |
| G06 | 73 | A2 | NonModHist | Min | -41 | -23 | -8 | -129 | -1,467 | -14,859 |
| G06 | 0 | A3 | NonModHist | Max | 41 | 23 | 9 | 121 | 1,218 | 13,384 |
| G06 | 73 | A3 | NonModHist | Max | 41 | 23 | 9 | 121 | 1,422 | 14,591 |
| G06 | 0 | A3 | NonModHist | Min | -34 | -19 | -7 | -133 | -1,175 | -14,892 |
| G06 | 73 | A3 | NonModHist | Min | -34 | -19 | -7 | -133 | -1,348 | -16,481 |
| G06 | 0 | A4 | NonModHist | Max | 37 | 21 | 8 | 131 | 1,135 | 13,878 |
| G06 | 73 | A4 | NonModHist | Max | 37 | 21 | 8 | 131 | 1,477 | 15,192 |
| G06 | 0 | A4 | NonModHist | Min | -47 | -21 | -8 | -135 | -1,217 | -13,551 |
| G06 | 73 | A4 | NonModHist | Min | -47 | -21 | -8 | -135 | -1,512 | -14,989 |
| G06 | 0 | A5 | NonModHist | Max | 44 | 23 | 10 | 151 | 1,287 | 14,548 |
| G06 | 73 | A5 | NonModHist | Max | 44 | 23 | 10 | 151 | 1,468 | 16,089 |
| G06 | 0 | A5 | NonModHist | Min | -51 | -21 | -9 | -144 | -1,199 | -15,016 |
| G06 | 73 | A5 | NonModHist | Min | -51 | -21 | -9 | -144 | -1,688 | -16,499 |
| G06 | 0 | EQ | Combination | Max | 45 | 23 | 9 | 137 | 1,252 | 14,323 |
| G06 | 73 | EQ | Combination | Max | 45 | 23 | 9 | 137 | 1,526 | 15,742 |
| G06 | 0 | EQ | Combination | Min | -45 | -23 | -9 | -137 | -1,252 | -14,323 |
| G06 | 73 | EQ | Combination | Min | -45 | -23 | -9 | -137 | -1,526 | -15,742 |
| G06 | 0 | C08 | Combination | Max | 45 | -10 | 9 | 138 | 1,252 | 44,078 |
| G06 | 73 | C08 | Combination | Max | 45 | -7 | 9 | 138 | 1,525 | 47,757 |
| G06 | 0 | C08 | Combination | Min | -45 | -55 | -9 | -136 | -1,252 | 15,432 |
| G06 | 73 | C08 | Combination | Min | -45 | -52 | -9 | -136 | -1,526 | 16,273 |
| **Maximum Absolute for Case A1:** | | | | | **45** | **23** | **9** | **136** | **1,541** | **15,680** |
| **Maximum Absolute for Case A2:** | | | | | **41** | **23** | **9** | **132** | **1,467** | **14,859** |
| **Maximum Absolute for Case A3:** | | | | | **41** | **23** | **9** | **133** | **1,422** | **16,481** |
| **Maximum Absolute for Case A4:** | | | | | **47** | **21** | **8** | **135** | **1,512** | **15,192** |
| **Maximum Absolute for Case A5:** | | | | | **51** | **23** | **10** | **151** | **1,688** | **16,499** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **45** | **23** | **9** | **137** | **1,526** | **15,742** |
| **Maximum Absolute for Case "EQ":** | | | | | **45** | **23** | **9** | **137** | **1,526** | **15,742** |
| **"DL":** | | | | | **0** | **6** | **0** | **0** | **0** | **13,206** |
| **"LL":** | | | | | **0** | **27** | **0** | **1** | **0** | **18,809** |
| **DL+LL+EQ for Element and Case: G06 C08:** | | | | | **45** | **55** | **9** | **138** | **1,527** | **47,757** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G07 | 0 | DL | LinStatic | | 0 | 27 | 0 | 2 | 0 | 13,206 |
| G07 | 146 | DL | LinStatic | | 0 | 34 | 0 | 2 | -4 | 8,708 |
| G07 | 0 | LL | LinStatic | | 0 | 36 | 0 | 7 | 0 | 18,809 |
| G07 | 146 | LL | LinStatic | | 0 | 36 | 0 | 7 | -18 | 13,573 |
| G07 | 0 | A1 | NonModHist | Max | 28 | 32 | 10 | 304 | 1,351 | 15,894 |
| G07 | 146 | A1 | NonModHist | Max | 28 | 32 | 10 | 304 | 1,812 | 11,363 |
| G07 | 0 | A1 | NonModHist | Min | -35 | -31 | -8 | -308 | -1,541 | -15,442 |
| G07 | 146 | A1 | NonModHist | Min | -35 | -31 | -8 | -308 | -1,373 | -10,959 |
| G07 | 0 | A2 | NonModHist | Max | 30 | 28 | 8 | 323 | 1,428 | 13,588 |
| G07 | 146 | A2 | NonModHist | Max | 30 | 28 | 8 | 323 | 1,710 | 9,830 |
| G07 | 0 | A2 | NonModHist | Min | -30 | -29 | -8 | -321 | -1,467 | -14,622 |
| G07 | 146 | A2 | NonModHist | Min | -30 | -29 | -8 | -321 | -1,983 | -10,320 |
| G07 | 0 | A3 | NonModHist | Max | 28 | 29 | 9 | 312 | 1,422 | 14,904 |
| G07 | 146 | A3 | NonModHist | Max | 28 | 29 | 9 | 312 | 1,362 | 10,716 |
| G07 | 0 | A3 | NonModHist | Min | -26 | -32 | -9 | -331 | -1,348 | -16,160 |
| G07 | 146 | A3 | NonModHist | Min | -26 | -32 | -9 | -331 | -1,868 | -11,474 |
| G07 | 0 | A4 | NonModHist | Max | 33 | 30 | 9 | 324 | 1,477 | 15,410 |
| G07 | 146 | A4 | NonModHist | Max | 33 | 30 | 9 | 324 | 1,830 | 11,132 |
| G07 | 0 | A4 | NonModHist | Min | -43 | -30 | -9 | -278 | -1,512 | -14,695 |
| G07 | 146 | A4 | NonModHist | Min | -43 | -30 | -9 | -278 | -1,692 | -10,488 |
| G07 | 0 | A5 | NonModHist | Max | 34 | 33 | 9 | 384 | 1,468 | 15,807 |
| G07 | 146 | A5 | NonModHist | Max | 34 | 33 | 9 | 384 | 1,808 | 10,958 |
| G07 | 0 | A5 | NonModHist | Min | -38 | -33 | -9 | -406 | -1,688 | -16,585 |
| G07 | 146 | A5 | NonModHist | Min | -38 | -33 | -9 | -406 | -2,285 | -11,881 |
| G07 | 0 | EQ | Combination | Max | 35 | 31 | 9 | 338 | 1,526 | 15,734 |
| G07 | 146 | EQ | Combination | Max | 35 | 31 | 9 | 338 | 1,955 | 11,234 |
| G07 | 0 | EQ | Combination | Min | -35 | -31 | -9 | -338 | -1,526 | -15,734 |
| G07 | 146 | EQ | Combination | Min | -35 | -31 | -9 | -338 | -1,955 | -11,234 |
| G07 | 0 | C08 | Combination | Max | 35 | 95 | 9 | 347 | 1,525 | 47,750 |
| G07 | 146 | C08 | Combination | Max | 35 | 101 | 9 | 347 | 1,933 | 33,515 |
| G07 | 0 | C08 | Combination | Min | -35 | 32 | -9 | -329 | -1,526 | 16,281 |
| G07 | 146 | C08 | Combination | Min | -35 | 39 | -9 | -329 | -1,977 | 11,048 |
| **Maximum Absolute for Case A1:** | | | | | **35** | **32** | **10** | **308** | **1,812** | **15,894** |
| **Maximum Absolute for Case A2:** | | | | | **30** | **29** | **8** | **323** | **1,983** | **14,622** |
| **Maximum Absolute for Case A3:** | | | | | **28** | **32** | **9** | **331** | **1,868** | **16,160** |
| **Maximum Absolute for Case A4:** | | | | | **43** | **30** | **9** | **324** | **1,830** | **15,410** |
| **Maximum Absolute for Case A5:** | | | | | **38** | **33** | **9** | **406** | **2,285** | **16,585** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **35** | **31** | **9** | **338** | **1,955** | **15,734** |
| **Maximum Absolute for Case "EQ":** | | | | | **35** | **31** | **9** | **338** | **1,955** | **15,734** |
| **"DL":** | | | | | **0** | **34** | **0** | **2** | **4** | **13,206** |
| **"LL":** | | | | | **0** | **36** | **0** | **7** | **18** | **18,809** |
| **DL+LL+EQ for Element and Case: G07 C08:** | | | | | **35** | **101** | **9** | **347** | **1,977** | **47,750** |

| Case-08: Element Forces – Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G08 | 0 | DL | LinStatic | | 0 | 60 | 0 | -3 | -4 | 8,708 |
| G08 | 138 | DL | LinStatic | | 0 | 66 | 0 | -3 | 4 | -1 |
| G08 | 0 | LL | LinStatic | | 0 | 98 | 0 | -10 | -18 | 13,573 |
| G08 | 138 | LL | LinStatic | | 0 | 98 | 0 | -10 | 6 | 0 |
| G08 | 0 | A1 | NonModHist | Max | 22 | 82 | 11 | 442 | 1,812 | 11,363 |
| G08 | 138 | A1 | NonModHist | Max | 22 | 82 | 11 | 442 | 2,459 | 960 |
| G08 | 0 | A1 | NonModHist | Min | -27 | -79 | -10 | -454 | -1,373 | -10,959 |
| G08 | 138 | A1 | NonModHist | Min | -27 | -79 | -10 | -454 | -2,402 | -973 |
| G08 | 0 | A2 | NonModHist | Max | 23 | 69 | 9 | 415 | 1,710 | 9,830 |
| G08 | 138 | A2 | NonModHist | Max | 23 | 69 | 9 | 415 | 2,165 | 956 |
| G08 | 0 | A2 | NonModHist | Min | -24 | -74 | -11 | -468 | -1,983 | -10,320 |
| G08 | 138 | A2 | NonModHist | Min | -24 | -74 | -11 | -468 | -2,503 | -859 |
| G08 | 0 | A3 | NonModHist | Max | 24 | 79 | 12 | 426 | 1,362 | 10,716 |
| G08 | 138 | A3 | NonModHist | Max | 24 | 79 | 12 | 426 | 2,261 | 982 |
| G08 | 0 | A3 | NonModHist | Min | -23 | -82 | -10 | -393 | -1,868 | -11,474 |
| G08 | 138 | A3 | NonModHist | Min | -23 | -82 | -10 | -393 | -2,508 | -939 |
| G08 | 0 | A4 | NonModHist | Max | 25 | 79 | 10 | 459 | 1,830 | 11,132 |
| G08 | 138 | A4 | NonModHist | Max | 25 | 79 | 10 | 459 | 2,481 | 1,120 |
| G08 | 0 | A4 | NonModHist | Min | -33 | -76 | -9 | -425 | -1,692 | -10,488 |
| G08 | 138 | A4 | NonModHist | Min | -33 | -76 | -9 | -425 | -2,410 | -1,008 |
| G08 | 0 | A5 | NonModHist | Max | 27 | 81 | 10 | 417 | 1,808 | 10,958 |
| G08 | 138 | A5 | NonModHist | Max | 27 | 81 | 10 | 417 | 2,394 | 1,246 |
| G08 | 0 | A5 | NonModHist | Min | -32 | -82 | -10 | -437 | -2,285 | -11,881 |
| G08 | 138 | A5 | NonModHist | Min | -32 | -82 | -10 | -437 | -2,916 | -974 |
| G08 | 0 | EQ | Combination | Max | 28 | 80 | 11 | 449 | 1,955 | 11,234 |
| G08 | 138 | EQ | Combination | Max | 28 | 80 | 11 | 449 | 2,573 | 1,055 |
| G08 | 0 | EQ | Combination | Min | -28 | -80 | -11 | -449 | -1,955 | -11,234 |
| G08 | 138 | EQ | Combination | Min | -28 | -80 | -11 | -449 | -2,573 | -1,055 |
| G08 | 0 | C08 | Combination | Max | 28 | 238 | 11 | 436 | 1,933 | 33,515 |
| G08 | 138 | C08 | Combination | Max | 28 | 244 | 11 | 436 | 2,583 | 1,054 |
| G08 | 0 | C08 | Combination | Min | -28 | 78 | -11 | -461 | -1,977 | 11,048 |
| G08 | 138 | C08 | Combination | Min | -28 | 85 | -11 | -461 | -2,563 | -1,056 |
| **Maximum Absolute for Case A1:** | | | | | **27** | **82** | **11** | **454** | **2,459** | **11,363** |
| **Maximum Absolute for Case A2:** | | | | | **24** | **74** | **11** | **468** | **2,503** | **10,320** |
| **Maximum Absolute for Case A3:** | | | | | **24** | **82** | **12** | **426** | **2,508** | **11,474** |
| **Maximum Absolute for Case A4:** | | | | | **33** | **79** | **10** | **459** | **2,481** | **11,132** |
| **Maximum Absolute for Case A5:** | | | | | **32** | **82** | **10** | **437** | **2,916** | **11,881** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **28** | **80** | **11** | **449** | **2,573** | **11,234** |
| **Maximum Absolute for Case "EQ":** | | | | | **28** | **80** | **11** | **449** | **2,573** | **11,234** |
| **"DL":** | | | | | **0** | **66** | **0** | **3** | **4** | **8,708** |
| **"LL":** | | | | | **0** | **98** | **0** | **10** | **18** | **13,573** |
| **DL+LL+EQ for Element and Case: G08 C08:** | | | | | **28** | **244** | **11** | **461** | **2,596** | **33,515** |

| Case-09: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G01 | 0 | DL | LinStatic | | 0 | -27 | 0 | 1 | 2 | -2 |
| G01 | 146 | DL | LinStatic | | 0 | -20 | 0 | 1 | 1 | 3,451 |
| G01 | 0 | LL | LinStatic | | 0 | -9 | 0 | 1 | 1 | 0 |
| G01 | 146 | LL | LinStatic | | 0 | -9 | 0 | 1 | 0 | 1,346 |
| G01 | 0 | A1 | NonModHist | Max | 75 | 8 | 6 | 82 | 1,783 | 344 |
| G01 | 146 | A1 | NonModHist | Max | 75 | 8 | 6 | 82 | 1,359 | 1,466 |
| G01 | 0 | A1 | NonModHist | Min | -71 | -9 | -7 | -60 | -2,118 | -413 |
| G01 | 146 | A1 | NonModHist | Min | -71 | -9 | -7 | -60 | -1,621 | -1,156 |
| G01 | 0 | A2 | NonModHist | Max | 70 | 9 | 8 | 74 | 1,946 | 399 |
| G01 | 146 | A2 | NonModHist | Max | 70 | 9 | 8 | 74 | 1,659 | 1,354 |
| G01 | 0 | A2 | NonModHist | Min | -69 | -7 | -7 | -68 | -1,856 | -328 |
| G01 | 146 | A2 | NonModHist | Min | -69 | -7 | -7 | -68 | -1,563 | -1,468 |
| G01 | 0 | A3 | NonModHist | Max | 86 | 9 | 7 | 70 | 2,331 | 462 |
| G01 | 146 | A3 | NonModHist | Max | 86 | 9 | 7 | 70 | 1,720 | 1,195 |
| G01 | 0 | A3 | NonModHist | Min | -77 | -9 | -7 | -73 | -1,633 | -468 |
| G01 | 146 | A3 | NonModHist | Min | -77 | -9 | -7 | -73 | -1,286 | -1,248 |
| G01 | 0 | A4 | NonModHist | Max | 66 | 9 | 6 | 68 | 1,944 | 480 |
| G01 | 146 | A4 | NonModHist | Max | 66 | 9 | 6 | 68 | 1,494 | 1,339 |
| G01 | 0 | A4 | NonModHist | Min | -95 | -9 | -7 | -74 | -1,875 | -454 |
| G01 | 146 | A4 | NonModHist | Min | -95 | -9 | -7 | -74 | -1,638 | -1,476 |
| G01 | 0 | A5 | NonModHist | Max | 76 | 10 | 8 | 75 | 2,231 | 464 |
| G01 | 146 | A5 | NonModHist | Max | 76 | 10 | 8 | 75 | 2,083 | 1,421 |
| G01 | 0 | A5 | NonModHist | Min | -65 | -11 | -7 | -69 | -1,862 | -499 |
| G01 | 146 | A5 | NonModHist | Min | -65 | -11 | -7 | -69 | -1,602 | -1,654 |
| G01 | 0 | EQ | Combination | Max | 80 | 9 | 7 | 75 | 2,114 | 452 |
| G01 | 146 | EQ | Combination | Max | 80 | 9 | 7 | 75 | 1,744 | 1,462 |
| G01 | 0 | EQ | Combination | Min | -80 | -9 | -7 | -75 | -2,114 | -452 |
| G01 | 146 | EQ | Combination | Min | -80 | -9 | -7 | -75 | -1,744 | -1,462 |
| G01 | 0 | C09 | Combination | Max | 80 | -27 | 7 | 77 | 2,116 | 449 |
| G01 | 146 | C09 | Combination | Max | 80 | -20 | 7 | 77 | 1,746 | 6,259 |
| G01 | 0 | C09 | Combination | Min | -80 | -46 | -7 | -74 | -2,112 | -454 |
| G01 | 146 | C09 | Combination | Min | -80 | -39 | -7 | -74 | -1,743 | 3,334 |
| **Maximum Absolute for Case A1:** | | | | | **75** | **9** | **7** | **82** | **2,118** | **1,466** |
| **Maximum Absolute for Case A2:** | | | | | **70** | **9** | **8** | **74** | **1,946** | **1,468** |
| **Maximum Absolute for Case A3:** | | | | | **86** | **9** | **7** | **73** | **2,331** | **1,248** |
| **Maximum Absolute for Case A4:** | | | | | **95** | **9** | **7** | **74** | **1,944** | **1,476** |
| **Maximum Absolute for Case A5:** | | | | | **76** | **11** | **8** | **75** | **2,231** | **1,654** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **80** | **9** | **7** | **75** | **2,114** | **1,462** |
| **Maximum Absolute for Case "EQ":** | | | | | **80** | **9** | **7** | **75** | **2,114** | **1,462** |
| **"DL":** | | | | | **0** | **27** | **0** | **1** | **2** | **3,451** |
| **"LL":** | | | | | **0** | **9** | **0** | **1** | **1** | **1,346** |
| **DL+LL+EQ for Element and Case: G01 C09:** | | | | | **80** | **46** | **7** | **77** | **2,116** | **6,259** |

| Case-09: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G02 | 0 | DL | LinStatic | | 0 | -20 | 0 | 1 | 1 | 3,451 |
| G02 | 138 | DL | LinStatic | | 0 | -14 | 0 | 1 | 1 | 5,824 |
| G02 | 0 | LL | LinStatic | | 0 | -9 | 0 | 1 | 0 | 1,346 |
| G02 | 138 | LL | LinStatic | | 0 | -9 | 0 | 1 | 0 | 2,618 |
| G02 | 0 | A1 | NonModHist | Max | 65 | 8 | 6 | 82 | 1,359 | 1,466 |
| G02 | 138 | A1 | NonModHist | Max | 65 | 8 | 6 | 82 | 1,507 | 2,509 |
| G02 | 0 | A1 | NonModHist | Min | -62 | -8 | -6 | -60 | -1,621 | -1,156 |
| G02 | 138 | A1 | NonModHist | Min | -62 | -8 | -6 | -60 | -1,507 | -2,204 |
| G02 | 0 | A2 | NonModHist | Max | 63 | 8 | 7 | 74 | 1,659 | 1,354 |
| G02 | 138 | A2 | NonModHist | Max | 63 | 8 | 7 | 74 | 1,539 | 2,222 |
| G02 | 0 | A2 | NonModHist | Min | -61 | -6 | -5 | -68 | -1,563 | -1,468 |
| G02 | 138 | A2 | NonModHist | Min | -61 | -6 | -5 | -68 | -1,258 | -2,620 |
| G02 | 0 | A3 | NonModHist | Max | 76 | 8 | 6 | 70 | 1,720 | 1,195 |
| G02 | 138 | A3 | NonModHist | Max | 76 | 8 | 6 | 70 | 1,622 | 2,268 |
| G02 | 0 | A3 | NonModHist | Min | -67 | -8 | -6 | -73 | -1,286 | -1,248 |
| G02 | 138 | A3 | NonModHist | Min | -67 | -8 | -6 | -73 | -1,435 | -2,341 |
| G02 | 0 | A4 | NonModHist | Max | 59 | 8 | 5 | 68 | 1,494 | 1,339 |
| G02 | 138 | A4 | NonModHist | Max | 59 | 8 | 5 | 68 | 1,395 | 2,402 |
| G02 | 0 | A4 | NonModHist | Min | -84 | -9 | -5 | -74 | -1,638 | -1,476 |
| G02 | 138 | A4 | NonModHist | Min | -84 | -9 | -5 | -74 | -1,412 | -2,375 |
| G02 | 0 | A5 | NonModHist | Max | 67 | 9 | 6 | 75 | 2,083 | 1,421 |
| G02 | 138 | A5 | NonModHist | Max | 67 | 9 | 6 | 75 | 1,895 | 2,679 |
| G02 | 0 | A5 | NonModHist | Min | -61 | -10 | -6 | -69 | -1,602 | -1,654 |
| G02 | 138 | A5 | NonModHist | Min | -61 | -10 | -6 | -69 | -1,457 | -2,855 |
| G02 | 0 | EQ | Combination | Max | 71 | 8 | 6 | 75 | 1,744 | 1,462 |
| G02 | 138 | EQ | Combination | Max | 71 | 8 | 6 | 75 | 1,595 | 2,545 |
| G02 | 0 | EQ | Combination | Min | -71 | -8 | -6 | -75 | -1,744 | -1,462 |
| G02 | 138 | EQ | Combination | Min | -71 | -8 | -6 | -75 | -1,595 | -2,545 |
| G02 | 0 | C09 | Combination | Max | 71 | -21 | 6 | 77 | 1,746 | 6,259 |
| G02 | 138 | C09 | Combination | Max | 71 | -15 | 6 | 77 | 1,596 | 10,988 |
| G02 | 0 | C09 | Combination | Min | -71 | -38 | -6 | -74 | -1,743 | 3,334 |
| G02 | 138 | C09 | Combination | Min | -71 | -32 | -6 | -74 | -1,594 | 5,897 |
| **Maximum Absolute for Case A1:** | | | | | **65** | **8** | **6** | **82** | **1,621** | **2,509** |
| **Maximum Absolute for Case A2:** | | | | | **63** | **8** | **7** | **74** | **1,659** | **2,620** |
| **Maximum Absolute for Case A3:** | | | | | **76** | **8** | **6** | **73** | **1,720** | **2,341** |
| **Maximum Absolute for Case A4:** | | | | | **84** | **9** | **5** | **74** | **1,638** | **2,402** |
| **Maximum Absolute for Case A5:** | | | | | **67** | **10** | **6** | **75** | **2,083** | **2,855** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **71** | **8** | **6** | **75** | **1,744** | **2,545** |
| **Maximum Absolute for Case "EQ":** | | | | | **71** | **8** | **6** | **75** | **1,744** | **2,545** |
| **"DL":** | | | | | **0** | **20** | **0** | **1** | **1** | **5,824** |
| **"LL":** | | | | | **0** | **9** | **0** | **1** | **0** | **2,618** |
| **DL+LL+EQ for Element and Case: G02 C09:** | | | | | **71** | **38** | **6** | **77** | **1,746** | **10,988** |

| Case-09: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G03 | 0 | DL | LinStatic | | 0 | -14 | 0 | 1 | 1 | 5,824 |
| G03 | 174.5 | DL | LinStatic | | 0 | -6 | 0 | 1 | 0 | 7,586 |
| G03 | 0 | LL | LinStatic | | 0 | -9 | 0 | 1 | 0 | 2,618 |
| G03 | 174.5 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 4,226 |
| G03 | 0 | A1 | NonModHist | Max | 55 | 7 | 5 | 82 | 1,507 | 2,509 |
| G03 | 174.5 | A1 | NonModHist | Max | 55 | 7 | 5 | 82 | 1,239 | 3,640 |
| G03 | 0 | A1 | NonModHist | Min | -56 | -6 | -5 | -60 | -1,507 | -2,204 |
| G03 | 174.5 | A1 | NonModHist | Min | -56 | -6 | -5 | -60 | -1,082 | -3,380 |
| G03 | 0 | A2 | NonModHist | Max | 55 | 7 | 5 | 74 | 1,539 | 2,222 |
| G03 | 174.5 | A2 | NonModHist | Max | 55 | 7 | 5 | 74 | 905 | 3,146 |
| G03 | 0 | A2 | NonModHist | Min | -52 | -5 | -5 | -68 | -1,258 | -2,620 |
| G03 | 174.5 | A2 | NonModHist | Min | -52 | -5 | -5 | -68 | -1,219 | -3,754 |
| G03 | 0 | A3 | NonModHist | Max | 64 | 7 | 5 | 70 | 1,622 | 2,268 |
| G03 | 174.5 | A3 | NonModHist | Max | 64 | 7 | 5 | 70 | 1,178 | 3,368 |
| G03 | 0 | A3 | NonModHist | Min | -57 | -6 | -5 | -73 | -1,435 | -2,341 |
| G03 | 174.5 | A3 | NonModHist | Min | -57 | -6 | -5 | -73 | -1,181 | -3,496 |
| G03 | 0 | A4 | NonModHist | Max | 50 | 7 | 5 | 68 | 1,395 | 2,402 |
| G03 | 174.5 | A4 | NonModHist | Max | 50 | 7 | 5 | 68 | 1,007 | 3,579 |
| G03 | 0 | A4 | NonModHist | Min | -72 | -7 | -5 | -74 | -1,412 | -2,375 |
| G03 | 174.5 | A4 | NonModHist | Min | -72 | -7 | -5 | -74 | -979 | -3,329 |
| G03 | 0 | A5 | NonModHist | Max | 56 | 7 | 6 | 75 | 1,895 | 2,679 |
| G03 | 174.5 | A5 | NonModHist | Max | 56 | 7 | 6 | 75 | 1,176 | 3,896 |
| G03 | 0 | A5 | NonModHist | Min | -56 | -7 | -5 | -69 | -1,457 | -2,855 |
| G03 | 174.5 | A5 | NonModHist | Min | -56 | -7 | -5 | -69 | -1,330 | -3,974 |
| G03 | 0 | EQ | Combination | Max | 61 | 7 | 5 | 75 | 1,595 | 2,545 |
| G03 | 174.5 | EQ | Combination | Max | 61 | 7 | 5 | 75 | 1,195 | 3,689 |
| G03 | 0 | EQ | Combination | Min | -61 | -7 | -5 | -75 | -1,595 | -2,545 |
| G03 | 174.5 | EQ | Combination | Min | -61 | -7 | -5 | -75 | -1,195 | -3,689 |
| G03 | 0 | C09 | Combination | Max | 61 | -16 | 5 | 77 | 1,596 | 10,988 |
| G03 | 174.5 | C09 | Combination | Max | 61 | -9 | 5 | 77 | 1,195 | 15,501 |
| G03 | 0 | C09 | Combination | Min | -61 | -30 | -5 | -74 | -1,594 | 5,897 |
| G03 | 174.5 | C09 | Combination | Min | -61 | -22 | -5 | -74 | -1,195 | 8,124 |
| **Maximum Absolute for Case A1:** | | | | | **56** | **7** | **5** | **82** | **1,507** | **3,640** |
| **Maximum Absolute for Case A2:** | | | | | **55** | **7** | **5** | **74** | **1,539** | **3,754** |
| **Maximum Absolute for Case A3:** | | | | | **64** | **7** | **5** | **73** | **1,622** | **3,496** |
| **Maximum Absolute for Case A4:** | | | | | **72** | **7** | **5** | **74** | **1,412** | **3,579** |
| **Maximum Absolute for Case A5:** | | | | | **56** | **7** | **6** | **75** | **1,895** | **3,974** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **61** | **7** | **5** | **75** | **1,595** | **3,689** |
| **Maximum Absolute for Case "EQ":** | | | | | **61** | **7** | **5** | **75** | **1,595** | **3,689** |
| **"DL":** | | | | | **0** | **14** | **0** | **1** | **1** | **7,586** |
| **"LL":** | | | | | **0** | **9** | **0** | **1** | **1** | **4,226** |
| **DL+LL+EQ for Element and Case: G03 C09:** | | | | | **61** | **30** | **5** | **77** | **1,596** | **15,501** |

| Case-09: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G04 | 0 | DL | LinStatic | | 0 | -6 | 0 | 1 | 0 | 7,586 |
| G04 | 36.5 | DL | LinStatic | | 0 | -4 | 0 | 1 | 0 | 7,780 |
| G04 | 0 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 4,226 |
| G04 | 36.5 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 4,563 |
| G04 | 0 | A1 | NonModHist | Max | 48 | 6 | 5 | 82 | 1,239 | 3,640 |
| G04 | 36.5 | A1 | NonModHist | Max | 48 | 6 | 5 | 82 | 1,207 | 3,842 |
| G04 | 0 | A1 | NonModHist | Min | -51 | -6 | -6 | -60 | -1,082 | -3,380 |
| G04 | 36.5 | A1 | NonModHist | Min | -51 | -6 | -6 | -60 | -1,058 | -3,596 |
| G04 | 0 | A2 | NonModHist | Max | 49 | 6 | 6 | 74 | 905 | 3,146 |
| G04 | 36.5 | A2 | NonModHist | Max | 49 | 6 | 6 | 74 | 838 | 3,301 |
| G04 | 0 | A2 | NonModHist | Min | -46 | -5 | -5 | -68 | -1,219 | -3,754 |
| G04 | 36.5 | A2 | NonModHist | Min | -46 | -5 | -5 | -68 | -1,150 | -3,946 |
| G04 | 0 | A3 | NonModHist | Max | 55 | 6 | 6 | 70 | 1,178 | 3,368 |
| G04 | 36.5 | A3 | NonModHist | Max | 55 | 6 | 6 | 70 | 1,120 | 3,555 |
| G04 | 0 | A3 | NonModHist | Min | -49 | -6 | -5 | -73 | -1,181 | -3,496 |
| G04 | 36.5 | A3 | NonModHist | Min | -49 | -6 | -5 | -73 | -1,042 | -3,696 |
| G04 | 0 | A4 | NonModHist | Max | 44 | 7 | 6 | 68 | 1,007 | 3,579 |
| G04 | 36.5 | A4 | NonModHist | Max | 44 | 7 | 6 | 68 | 959 | 3,780 |
| G04 | 0 | A4 | NonModHist | Min | -64 | -6 | -6 | -74 | -979 | -3,329 |
| G04 | 36.5 | A4 | NonModHist | Min | -64 | -6 | -6 | -74 | -934 | -3,556 |
| G04 | 0 | A5 | NonModHist | Max | 51 | 6 | 7 | 75 | 1,176 | 3,896 |
| G04 | 36.5 | A5 | NonModHist | Max | 51 | 6 | 7 | 75 | 1,128 | 4,087 |
| G04 | 0 | A5 | NonModHist | Min | -52 | -7 | -5 | -69 | -1,330 | -3,974 |
| G04 | 36.5 | A5 | NonModHist | Min | -52 | -7 | -5 | -69 | -1,284 | -4,150 |
| G04 | 0 | EQ | Combination | Max | 54 | 6 | 6 | 75 | 1,195 | 3,689 |
| G04 | 36.5 | EQ | Combination | Max | 54 | 6 | 6 | 75 | 1,144 | 3,883 |
| G04 | 0 | EQ | Combination | Min | -54 | -6 | -6 | -75 | -1,195 | -3,689 |
| G04 | 36.5 | EQ | Combination | Min | -54 | -6 | -6 | -75 | -1,144 | -3,883 |
| G04 | 0 | C09 | Combination | Max | 55 | -9 | 6 | 77 | 1,195 | 15,501 |
| G04 | 36.5 | C09 | Combination | Max | 55 | -8 | 6 | 77 | 1,143 | 16,225 |
| G04 | 0 | C09 | Combination | Min | -54 | -21 | -6 | -74 | -1,195 | 8,124 |
| G04 | 36.5 | C09 | Combination | Min | -54 | -20 | -6 | -74 | -1,144 | 8,460 |
| **Maximum Absolute for Case A1:** | | | | | **51** | **6** | **6** | **82** | **1,239** | **3,842** |
| **Maximum Absolute for Case A2:** | | | | | **49** | **6** | **6** | **74** | **1,219** | **3,946** |
| **Maximum Absolute for Case A3:** | | | | | **55** | **6** | **6** | **73** | **1,181** | **3,696** |
| **Maximum Absolute for Case A4:** | | | | | **64** | **7** | **6** | **74** | **1,007** | **3,780** |
| **Maximum Absolute for Case A5:** | | | | | **52** | **7** | **7** | **75** | **1,330** | **4,150** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **54** | **6** | **6** | **75** | **1,195** | **3,883** |
| **Maximum Absolute for Case "EQ":** | | | | | **54** | **6** | **6** | **75** | **1,195** | **3,883** |
| **"DL":** | | | | | **0** | **6** | **0** | **1** | **0** | **7,780** |
| **"LL":** | | | | | **0** | **9** | **0** | **1** | **1** | **4,563** |
| **DL+LL+EQ for Element and Case: G04 C09:** | | | | | **55** | **21** | **6** | **77** | **1,196** | **16,225** |

| Case-09: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G05 | 0 | DL | LinStatic | | 0 | -4 | 0 | 1 | 0 | 7,780 |
| G05 | 129.5 | DL | LinStatic | | 0 | 1 | 0 | 1 | 0 | 7,978 |
| G05 | 0 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 4,563 |
| G05 | 129.5 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 5,756 |
| G05 | 0 | A1 | NonModHist | Max | 42 | 7 | 7 | 82 | 1,207 | 3,842 |
| G05 | 129.5 | A1 | NonModHist | Max | 42 | 7 | 7 | 82 | 837 | 4,468 |
| G05 | 0 | A1 | NonModHist | Min | -47 | -6 | -7 | -60 | -1,058 | -3,596 |
| G05 | 129.5 | A1 | NonModHist | Min | -47 | -6 | -7 | -60 | -969 | -4,276 |
| G05 | 0 | A2 | NonModHist | Max | 45 | 5 | 7 | 74 | 838 | 3,301 |
| G05 | 129.5 | A2 | NonModHist | Max | 45 | 5 | 7 | 74 | 705 | 3,770 |
| G05 | 0 | A2 | NonModHist | Min | -41 | -5 | -6 | -68 | -1,150 | -3,946 |
| G05 | 129.5 | A2 | NonModHist | Min | -41 | -5 | -6 | -68 | -792 | -4,526 |
| G05 | 0 | A3 | NonModHist | Max | 49 | 6 | 7 | 70 | 1,120 | 3,555 |
| G05 | 129.5 | A3 | NonModHist | Max | 49 | 6 | 7 | 70 | 853 | 4,103 |
| G05 | 0 | A3 | NonModHist | Min | -43 | -6 | -6 | -73 | -1,042 | -3,696 |
| G05 | 129.5 | A3 | NonModHist | Min | -43 | -6 | -6 | -73 | -894 | -4,283 |
| G05 | 0 | A4 | NonModHist | Max | 39 | 7 | 7 | 68 | 959 | 3,780 |
| G05 | 129.5 | A4 | NonModHist | Max | 39 | 7 | 7 | 68 | 740 | 4,367 |
| G05 | 0 | A4 | NonModHist | Min | -58 | -6 | -6 | -74 | -934 | -3,556 |
| G05 | 129.5 | A4 | NonModHist | Min | -58 | -6 | -6 | -74 | -805 | -4,284 |
| G05 | 0 | A5 | NonModHist | Max | 47 | 6 | 8 | 75 | 1,128 | 4,087 |
| G05 | 129.5 | A5 | NonModHist | Max | 47 | 6 | 8 | 75 | 983 | 4,627 |
| G05 | 0 | A5 | NonModHist | Min | -49 | -6 | -7 | -69 | -1,284 | -4,150 |
| G05 | 129.5 | A5 | NonModHist | Min | -49 | -6 | -7 | -69 | -794 | -4,701 |
| G05 | 0 | EQ | Combination | Max | 50 | 6 | 7 | 75 | 1,144 | 3,883 |
| G05 | 129.5 | EQ | Combination | Max | 50 | 6 | 7 | 75 | 889 | 4,469 |
| G05 | 0 | EQ | Combination | Min | -50 | -6 | -7 | -75 | -1,144 | -3,883 |
| G05 | 129.5 | EQ | Combination | Min | -50 | -6 | -7 | -75 | -889 | -4,469 |
| G05 | 0 | C09 | Combination | Max | 50 | -7 | 7 | 77 | 1,143 | 16,225 |
| G05 | 129.5 | C09 | Combination | Max | 50 | -2 | 7 | 77 | 887 | 18,203 |
| G05 | 0 | C09 | Combination | Min | -50 | -20 | -7 | -74 | -1,144 | 8,460 |
| G05 | 129.5 | C09 | Combination | Min | -50 | -14 | -7 | -74 | -890 | 9,265 |
| **Maximum Absolute for Case A1:** | | | | | **47** | **7** | **7** | **82** | **1,207** | **4,468** |
| **Maximum Absolute for Case A2:** | | | | | **45** | **5** | **7** | **74** | **1,150** | **4,526** |
| **Maximum Absolute for Case A3:** | | | | | **49** | **6** | **7** | **73** | **1,120** | **4,283** |
| **Maximum Absolute for Case A4:** | | | | | **58** | **7** | **7** | **74** | **959** | **4,367** |
| **Maximum Absolute for Case A5:** | | | | | **49** | **6** | **8** | **75** | **1,284** | **4,701** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **50** | **6** | **7** | **75** | **1,144** | **4,469** |
| **Maximum Absolute for Case "EQ":** | | | | | **50** | **6** | **7** | **75** | **1,144** | **4,469** |
| **"DL":** | | | | | **0** | **4** | **0** | **1** | **0** | **7,978** |
| **"LL":** | | | | | **0** | **9** | **0** | **1** | **1** | **5,756** |
| **DL+LL+EQ for Element and Case: G05 C09:** | | | | | **50** | **20** | **7** | **77** | **1,145** | **18,203** |

| Case-09: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G06 | 0 | DL | LinStatic | | 0 | 1 | 0 | 1 | 0 | 7,978 |
| G06 | 81.5 | DL | LinStatic | | 0 | 5 | 0 | 1 | 0 | 7,712 |
| G06 | 0 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 5,756 |
| G06 | 81.5 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 6,507 |
| G06 | 0 | A1 | NonModHist | Max | 36 | 7 | 8 | 82 | 837 | 4,468 |
| G06 | 81.5 | A1 | NonModHist | Max | 36 | 7 | 8 | 82 | 897 | 4,812 |
| G06 | 0 | A1 | NonModHist | Min | -42 | -6 | -8 | -60 | -969 | -4,276 |
| G06 | 81.5 | A1 | NonModHist | Min | -42 | -6 | -8 | -60 | -1,106 | -4,626 |
| G06 | 0 | A2 | NonModHist | Max | 39 | 5 | 7 | 74 | 705 | 3,770 |
| G06 | 81.5 | A2 | NonModHist | Max | 39 | 5 | 7 | 74 | 909 | 4,057 |
| G06 | 0 | A2 | NonModHist | Min | -35 | -5 | -7 | -68 | -792 | -4,526 |
| G06 | 81.5 | A2 | NonModHist | Min | -35 | -5 | -7 | -68 | -920 | -4,862 |
| G06 | 0 | A3 | NonModHist | Max | 40 | 5 | 7 | 70 | 853 | 4,103 |
| G06 | 81.5 | A3 | NonModHist | Max | 40 | 5 | 7 | 70 | 1,057 | 4,331 |
| G06 | 0 | A3 | NonModHist | Min | -36 | -6 | -7 | -73 | -894 | -4,283 |
| G06 | 81.5 | A3 | NonModHist | Min | -36 | -6 | -7 | -73 | -1,005 | -4,553 |
| G06 | 0 | A4 | NonModHist | Max | 32 | 7 | 7 | 68 | 740 | 4,367 |
| G06 | 81.5 | A4 | NonModHist | Max | 32 | 7 | 7 | 68 | 870 | 4,673 |
| G06 | 0 | A4 | NonModHist | Min | -50 | -6 | -7 | -74 | -805 | -4,284 |
| G06 | 81.5 | A4 | NonModHist | Min | -50 | -6 | -7 | -74 | -988 | -4,729 |
| G06 | 0 | A5 | NonModHist | Max | 42 | 5 | 9 | 75 | 983 | 4,627 |
| G06 | 81.5 | A5 | NonModHist | Max | 42 | 5 | 9 | 75 | 1,062 | 4,885 |
| G06 | 0 | A5 | NonModHist | Min | -46 | -6 | -7 | -69 | -794 | -4,701 |
| G06 | 81.5 | A5 | NonModHist | Min | -46 | -6 | -7 | -69 | -1,123 | -4,990 |
| G06 | 0 | EQ | Combination | Max | 44 | 6 | 8 | 75 | 889 | 4,469 |
| G06 | 81.5 | EQ | Combination | Max | 44 | 6 | 8 | 75 | 1,039 | 4,789 |
| G06 | 0 | EQ | Combination | Min | -44 | -6 | -8 | -75 | -889 | -4,469 |
| G06 | 81.5 | EQ | Combination | Min | -44 | -6 | -8 | -75 | -1,039 | -4,789 |
| G06 | 0 | C09 | Combination | Max | 44 | -2 | 8 | 77 | 887 | 18,203 |
| G06 | 81.5 | C09 | Combination | Max | 44 | 2 | 8 | 77 | 1,037 | 19,008 |
| G06 | 0 | C09 | Combination | Min | -44 | -14 | -8 | -74 | -890 | 9,265 |
| G06 | 81.5 | C09 | Combination | Min | -44 | -10 | -8 | -74 | -1,040 | 9,430 |
| **Maximum Absolute for Case A1:** | | | | | **42** | **7** | **8** | **82** | **1,106** | **4,812** |
| **Maximum Absolute for Case A2:** | | | | | **39** | **5** | **7** | **74** | **920** | **4,862** |
| **Maximum Absolute for Case A3:** | | | | | **40** | **6** | **7** | **73** | **1,057** | **4,553** |
| **Maximum Absolute for Case A4:** | | | | | **50** | **7** | **7** | **74** | **988** | **4,729** |
| **Maximum Absolute for Case A5:** | | | | | **46** | **6** | **9** | **75** | **1,123** | **4,990** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **44** | **6** | **8** | **75** | **1,039** | **4,789** |
| **Maximum Absolute for Case "EQ":** | | | | | **44** | **6** | **8** | **75** | **1,039** | **4,789** |
| **"DL":** | | | | | **0** | **5** | **0** | **1** | **0** | **7,978** |
| **"LL":** | | | | | **0** | **9** | **0** | **1** | **1** | **6,507** |
| **DL+LL+EQ for Element and Case: G06 C09:** | | | | | **44** | **20** | **8** | **77** | **1,040** | **19,274** |

| Case-09: Element Forces - Frames | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Station | Output | Case | Step | P | V2 | V3 | T | M2 | M3 |
| Element | in | Case | Type | Type | Kip | Kip | Kip | Kip-in | Kip-in | Kip-in |
| G07 | 0 | DL | LinStatic | | 0 | 5 | 0 | 1 | 0 | 7,712 |
| G07 | 138 | DL | LinStatic | | 0 | 11 | 0 | 1 | -1 | 6,572 |
| G07 | 0 | LL | LinStatic | | 0 | -9 | 0 | 1 | -1 | 6,507 |
| G07 | 138 | LL | LinStatic | | 0 | -9 | 0 | 1 | -2 | 7,779 |
| G07 | 0 | A1 | NonModHist | Max | 30 | 6 | 11 | 82 | 897 | 4,812 |
| G07 | 138 | A1 | NonModHist | Max | 30 | 6 | 11 | 82 | 1,717 | 5,330 |
| G07 | 0 | A1 | NonModHist | Min | -37 | -7 | -9 | -60 | -1,106 | -4,626 |
| G07 | 138 | A1 | NonModHist | Min | -37 | -7 | -9 | -60 | -1,820 | -5,140 |
| G07 | 0 | A2 | NonModHist | Max | 34 | 4 | 8 | 74 | 909 | 4,057 |
| G07 | 138 | A2 | NonModHist | Max | 34 | 4 | 8 | 74 | 1,512 | 4,435 |
| G07 | 0 | A2 | NonModHist | Min | -29 | -5 | -8 | -68 | -920 | -4,862 |
| G07 | 138 | A2 | NonModHist | Min | -29 | -5 | -8 | -68 | -1,851 | -5,347 |
| G07 | 0 | A3 | NonModHist | Max | 31 | 5 | 10 | 70 | 1,057 | 4,331 |
| G07 | 138 | A3 | NonModHist | Max | 31 | 5 | 10 | 70 | 1,357 | 4,666 |
| G07 | 0 | A3 | NonModHist | Min | -29 | -5 | -9 | -73 | -1,005 | -4,553 |
| G07 | 138 | A3 | NonModHist | Min | -29 | -5 | -9 | -73 | -1,839 | -4,842 |
| G07 | 0 | A4 | NonModHist | Max | 26 | 7 | 8 | 68 | 870 | 4,673 |
| G07 | 138 | A4 | NonModHist | Max | 26 | 7 | 8 | 68 | 1,634 | 5,257 |
| G07 | 0 | A4 | NonModHist | Min | -42 | -6 | -8 | -74 | -988 | -4,729 |
| G07 | 138 | A4 | NonModHist | Min | -42 | -6 | -8 | -74 | -1,696 | -5,379 |
| G07 | 0 | A5 | NonModHist | Max | 36 | 5 | 11 | 75 | 1,062 | 4,885 |
| G07 | 138 | A5 | NonModHist | Max | 36 | 5 | 11 | 75 | 1,776 | 5,246 |
| G07 | 0 | A5 | NonModHist | Min | -42 | -5 | -9 | -69 | -1,123 | -4,990 |
| G07 | 138 | A5 | NonModHist | Min | -42 | -5 | -9 | -69 | -2,324 | -5,521 |
| G07 | 0 | EQ | Combination | Max | 37 | 6 | 10 | 75 | 1,039 | 4,789 |
| G07 | 138 | EQ | Combination | Max | 37 | 6 | 10 | 75 | 1,906 | 5,284 |
| G07 | 0 | EQ | Combination | Min | -37 | -6 | -10 | -75 | -1,039 | -4,789 |
| G07 | 138 | EQ | Combination | Min | -37 | -6 | -10 | -75 | -1,906 | -5,284 |
| G07 | 0 | C09 | Combination | Max | 37 | 2 | 10 | 77 | 1,037 | 19,008 |
| G07 | 138 | C09 | Combination | Max | 37 | 8 | 10 | 77 | 1,904 | 19,636 |
| G07 | 0 | C09 | Combination | Min | -37 | -10 | -10 | -74 | -1,040 | 9,430 |
| G07 | 138 | C09 | Combination | Min | -37 | -4 | -10 | -74 | -1,908 | 9,068 |
| **Maximum Absolute for Case A1:** | | | | | **37** | **7** | **11** | **82** | **1,820** | **5,330** |
| **Maximum Absolute for Case A2:** | | | | | **34** | **5** | **8** | **74** | **1,851** | **5,347** |
| **Maximum Absolute for Case A3:** | | | | | **31** | **5** | **10** | **73** | **1,839** | **4,842** |
| **Maximum Absolute for Case A4:** | | | | | **42** | **7** | **8** | **74** | **1,696** | **5,379** |
| **Maximum Absolute for Case A5:** | | | | | **42** | **5** | **11** | **75** | **2,324** | **5,521** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **37** | **6** | **10** | **75** | **1,906** | **5,284** |
| **Maximum Absolute for Case "EQ":** | | | | | **37** | **6** | **10** | **75** | **1,906** | **5,284** |
| **"DL":** | | | | | **0** | **11** | **0** | **1** | **1** | **7,712** |
| **"LL":** | | | | | **0** | **9** | **0** | **1** | **2** | **7,779** |
| **DL+LL+EQ for Element and Case: G07 C09:** | | | | | **37** | **26** | **10** | **77** | **1,908** | **20,775** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| G08 | 0 | DL | LinStatic | | 0 | 42 | 0 | -1 | -1 | 6,572 |
| G08 | 146 | DL | LinStatic | | 0 | 48 | 0 | -1 | 2 | -1 |
| G08 | 0 | LL | LinStatic | | 0 | 53 | 0 | 0 | -2 | 7,779 |
| G08 | 146 | LL | LinStatic | | 0 | 53 | 0 | 0 | 2 | 0 |
| G08 | 0 | A1 | NonModHist | Max | 20 | 37 | 9 | 328 | 1,717 | 5,038 |
| G08 | 146 | A1 | NonModHist | Max | 20 | 37 | 9 | 328 | 2,472 | 916 |
| G08 | 0 | A1 | NonModHist | Min | -26 | -34 | -8 | -446 | -1,820 | -4,991 |
| G08 | 146 | A1 | NonModHist | Min | -26 | -34 | -8 | -446 | -2,116 | -919 |
| G08 | 0 | A2 | NonModHist | Max | 22 | 33 | 9 | 371 | 1,512 | 4,176 |
| G08 | 146 | A2 | NonModHist | Max | 22 | 33 | 9 | 371 | 1,976 | 892 |
| G08 | 0 | A2 | NonModHist | Min | -22 | -35 | -8 | -401 | -1,851 | -5,088 |
| G08 | 146 | A2 | NonModHist | Min | -22 | -35 | -8 | -401 | -2,175 | -782 |
| G08 | 0 | A3 | NonModHist | Max | 23 | 31 | 9 | 402 | 1,357 | 4,491 |
| G08 | 146 | A3 | NonModHist | Max | 23 | 31 | 9 | 402 | 2,146 | 880 |
| G08 | 0 | A3 | NonModHist | Min | -21 | -36 | -7 | -386 | -1,839 | -5,122 |
| G08 | 146 | A3 | NonModHist | Min | -21 | -36 | -7 | -386 | -2,346 | -889 |
| G08 | 0 | A4 | NonModHist | Max | 24 | 38 | 8 | 408 | 1,634 | 5,529 |
| G08 | 146 | A4 | NonModHist | Max | 24 | 38 | 8 | 408 | 2,226 | 940 |
| G08 | 0 | A4 | NonModHist | Min | -29 | -37 | -7 | -374 | -1,696 | -5,451 |
| G08 | 146 | A4 | NonModHist | Min | -29 | -37 | -7 | -374 | -2,181 | -874 |
| G08 | 0 | A5 | NonModHist | Max | 27 | 32 | 10 | 386 | 1,776 | 5,207 |
| G08 | 146 | A5 | NonModHist | Max | 27 | 32 | 10 | 386 | 2,270 | 1,275 |
| G08 | 0 | A5 | NonModHist | Min | -32 | -37 | -8 | -410 | -2,324 | -5,299 |
| G08 | 146 | A5 | NonModHist | Min | -32 | -37 | -8 | -410 | -3,050 | -981 |
| G08 | 0 | EQ | Combination | Max | 27 | 36 | 9 | 413 | 1,906 | 5,215 |
| G08 | 146 | EQ | Combination | Max | 27 | 36 | 9 | 413 | 2,454 | 983 |
| G08 | 0 | EQ | Combination | Min | -27 | -36 | -9 | -413 | -1,906 | -5,215 |
| G08 | 146 | EQ | Combination | Min | -27 | -36 | -9 | -413 | -2,454 | -983 |
| G08 | 0 | C09 | Combination | Max | 27 | 131 | 9 | 412 | 1,904 | 19,567 |
| G08 | 146 | C09 | Combination | Max | 27 | 138 | 9 | 412 | 2,458 | 982 |
| G08 | 0 | C09 | Combination | Min | -27 | 58 | -9 | -414 | -1,908 | 9,137 |
| G08 | 146 | C09 | Combination | Min | -27 | 65 | -9 | -414 | -2,450 | -984 |
| **Maximum Absolute for Case A1:** | | | | | **26** | **37** | **9** | **446** | **2,472** | **5,038** |
| **Maximum Absolute for Case A2:** | | | | | **22** | **35** | **9** | **401** | **2,175** | **5,088** |
| **Maximum Absolute for Case A3:** | | | | | **23** | **36** | **9** | **402** | **2,346** | **5,122** |
| **Maximum Absolute for Case A4:** | | | | | **29** | **38** | **8** | **408** | **2,226** | **5,529** |
| **Maximum Absolute for Case A5:** | | | | | **32** | **37** | **10** | **410** | **3,050** | **5,299** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | | **27** | **36** | **9** | **413** | **2,454** | **5,215** |
| **Maximum Absolute for Case "EQ":** | | | | | **27** | **36** | **9** | **413** | **2,454** | **5,215** |
| **"DL":** | | | | | **0** | **48** | **0** | **1** | **2** | **6,572** |
| **"LL":** | | | | | **0** | **53** | **0** | **0** | **2** | **7,779** |
| **DL+LL+EQ for Element and Case: G08 C09:** | | | | | **27** | **138** | **9** | **414** | **2,458** | **19,567** |

# CAL-20776-SE-007

## NON-LINEAR SEISMIC TIME HISTORY ANALYSIS OUTPUT

## ATTACHMENT Q
## JOINT RELATIVE DISPLACEMENT
## LOAD COMBINATION CHECK
## FOR
## JOINTS 10, 14, 301, and 500

## LOAD CASE-08 – TROLLEY AT QUARTER-SPAN

**Tabularized Selected Output- For Information Only**

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**Total Pages = 5**

**Displacement Coordinate Directions**

U1 = Model "+X" , Direction (Plant North)
U2 = Model "+Y" , Direction (Plant West)
U1 = Model "+Z" , Direction (Vertical)

| Q.1 Joint Displacement Load Combination for Joint 10 | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | U1 | U2 | U3 |
| No. | Case | Type | Type | in | in | in |
| 10 | DL | LinStatic | | 0.000 | 0.001 | 0.000 |
| 10 | LL | LinStatic | | 0.000 | 0.001 | 0.000 |
| 10 | A1 | NonModHist | Max | 0.000 | 2.559 | 0.000 |
| 10 | A1 | NonModHist | Min | 0.000 | -0.649 | 0.000 |
| 10 | A2 | NonModHist | Max | 0.000 | 1.698 | 0.000 |
| 10 | A2 | NonModHist | Min | 0.000 | -0.276 | 0.000 |
| 10 | A3 | NonModHist | Max | 0.000 | 0.253 | 0.000 |
| 10 | A3 | NonModHist | Min | 0.000 | -4.628 | 0.000 |
| 10 | A4 | NonModHist | Max | 0.000 | 1.290 | 0.000 |
| 10 | A4 | NonModHist | Min | 0.000 | -1.443 | 0.000 |
| 10 | A5 | NonModHist | Max | 0.000 | 1.602 | 0.000 |
| 10 | A5 | NonModHist | Min | 0.000 | -2.597 | 0.000 |
| 10 | EQ | Combination | Max | 0.000 | 2.585 | 0.000 |
| 10 | EQ | Combination | Min | 0.000 | -2.585 | 0.000 |
| 10 | C08 | Combination | Max | 0.000 | 2.586 | 0.000 |
| 10 | C08 | Combination | Min | 0.000 | -2.583 | 0.000 |
| **Maximum Absolute for Case A1:** | | | | **0.000** | **2.559** | **0.000** |
| **Maximum Absolute for Case A2:** | | | | **0.000** | **1.698** | **0.000** |
| **Maximum Absolute for Case A3:** | | | | **0.000** | **4.628** | **0.000** |
| **Maximum Absolute for Case A4:** | | | | **0.000** | **1.443** | **0.000** |
| **Maximum Absolute for Case A5:** | | | | **0.000** | **2.597** | **0.000** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | **0.000** | **2.585** | **0.000** |
| **Maximum Absolute for Case "EQ":** | | | | **0.000** | **2.585** | **0.000** |
| **"DL":** | | | | **0.000** | **0.001** | **0.000** |
| **"LL":** | | | | **0.000** | **0.001** | **0.000** |
| **DL+LL+EQ for Joint and Case: 10 C08:** | | | | **0.000** | **2.586** | **0.000** |

| Q.2 Joint Displacement Load Combination for Joint 14 | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | U1 | U2 | U3 |
| No. | Case | Type | Type | in | in | in |
| 14 | DL | LinStatic | | 0.003 | -0.001 | 0.000 |
| 14 | LL | LinStatic | | 0.003 | -0.001 | 0.000 |
| 14 | A1 | NonModHist | Max | 0.071 | 4.206 | 0.000 |
| 14 | A1 | NonModHist | Min | -0.087 | -1.894 | 0.000 |
| 14 | A2 | NonModHist | Max | 0.084 | 3.316 | 0.000 |
| 14 | A2 | NonModHist | Min | -0.076 | -1.372 | 0.000 |
| 14 | A3 | NonModHist | Max | 0.075 | 1.516 | 0.000 |
| 14 | A3 | NonModHist | Min | -0.072 | -6.632 | 0.000 |
| 14 | A4 | NonModHist | Max | 0.084 | 2.919 | 0.000 |
| 14 | A4 | NonModHist | Min | -0.111 | -2.786 | 0.000 |
| 14 | A5 | NonModHist | Max | 0.089 | 2.706 | 0.000 |
| 14 | A5 | NonModHist | Min | -0.110 | -4.226 | 0.000 |
| 14 | EQ | Combination | Max | 0.093 | 4.260 | 0.000 |
| 14 | EQ | Combination | Min | -0.093 | -4.260 | 0.000 |
| 14 | C08 | Combination | Max | 0.099 | 4.258 | 0.000 |
| 14 | C08 | Combination | Min | -0.087 | -4.261 | 0.000 |
| | | | **Maximum Absolute for Case A1:** | **0.087** | **4.206** | **0.000** |
| | | | **Maximum Absolute for Case A2:** | **0.084** | **3.316** | **0.000** |
| | | | **Maximum Absolute for Case A3:** | **0.075** | **6.632** | **0.000** |
| | | | **Maximum Absolute for Case A4:** | **0.111** | **2.919** | **0.000** |
| | | | **Maximum Absolute for Case A5:** | **0.110** | **4.226** | **0.000** |
| | | | **Average of Maximum Absolutes for Cases A1- A5:** | **0.093** | **4.260** | **0.000** |
| | | | **Maximum Absolute for Case "EQ":** | **0.093** | **4.260** | **0.000** |
| | | | **"DL":** | **0.003** | **-0.001** | **0.000** |
| | | | **"LL":** | **0.003** | **-0.001** | **0.000** |
| | | | **DL+LL+EQ for Joint and Case: 14 C08:** | **0.099** | **4.258** | **0.000** |

| Q.3 Joint Displacement Load Combination for Joint 301 | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | U1 | U2 | U3 |
| No. | Case | Type | Type | in | in | in |
| 301 | DL | LinStatic | | -0.042 | 0.002 | -0.226 |
| 301 | LL | LinStatic | | -0.048 | 0.002 | -0.283 |
| 301 | A1 | NonModHist | Max | 7.549 | 3.718 | 0.238 |
| 301 | A1 | NonModHist | Min | -5.606 | -1.652 | -0.242 |
| 301 | A2 | NonModHist | Max | 5.380 | 2.843 | 0.226 |
| 301 | A2 | NonModHist | Min | -13.890 | -0.970 | -0.206 |
| 301 | A3 | NonModHist | Max | 8.882 | 1.211 | 0.248 |
| 301 | A3 | NonModHist | Min | -9.483 | -6.099 | -0.228 |
| 301 | A4 | NonModHist | Max | 5.978 | 2.389 | 0.226 |
| 301 | A4 | NonModHist | Min | -12.251 | -2.447 | -0.237 |
| 301 | A5 | NonModHist | Max | 9.162 | 2.520 | 0.253 |
| 301 | A5 | NonModHist | Min | -4.931 | -3.813 | -0.242 |
| 301 | EQ | Combination | Max | 10.467 | 3.784 | 0.241 |
| 301 | EQ | Combination | Min | -10.467 | -3.784 | -0.241 |
| 301 | C08 | Combination | Max | 10.378 | 3.788 | -0.268 |
| 301 | C08 | Combination | Min | -10.556 | -3.781 | -0.750 |
| **Maximum Absolute for Case A1:** | | | | **7.549** | **3.718** | **0.242** |
| **Maximum Absolute for Case A2:** | | | | **13.890** | **2.843** | **0.226** |
| **Maximum Absolute for Case A3:** | | | | **9.483** | **6.099** | **0.248** |
| **Maximum Absolute for Case A4:** | | | | **12.251** | **2.447** | **0.237** |
| **Maximum Absolute for Case A5:** | | | | **9.162** | **3.813** | **0.253** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | **10.467** | **3.784** | **0.241** |
| **Maximum Absolute for Case "EQ":** | | | | **10.467** | **3.784** | **0.241** |
| **"DL":** | | | | **-0.042** | **0.002** | **-0.226** |
| **"LL":** | | | | **-0.048** | **0.002** | **-0.283** |
| **DL+LL+EQ for Joint and Case: 301 C08:** | | | | **10.378** | **3.788** | **-0.268** |

| Q.4 Joint Displacement Load Combination for Joint 5000 | | | | | | |
|---|---|---|---|---|---|---|
| Joint | Output | Case | Step | U1 | U2 | U3 |
| No. | Case | Type | Type | in | in | in |
| 500 | DL | LinStatic | | -0.042 | 0.001 | -0.211 |
| 500 | LL | LinStatic | | -0.048 | 0.002 | -1.286 |
| 500 | A1 | NonModHist | Max | 7.429 | 3.734 | 0.941 |
| 500 | A1 | NonModHist | Min | -4.505 | -1.558 | -0.925 |
| 500 | A2 | NonModHist | Max | 4.792 | 5.042 | 0.875 |
| 500 | A2 | NonModHist | Min | -18.459 | -2.603 | -0.808 |
| 500 | A3 | NonModHist | Max | 6.751 | 4.398 | 0.920 |
| 500 | A3 | NonModHist | Min | -10.755 | -6.453 | -0.909 |
| 500 | A4 | NonModHist | Max | 6.406 | 4.298 | 0.865 |
| 500 | A4 | NonModHist | Min | -14.050 | -7.216 | -0.958 |
| 500 | A5 | NonModHist | Max | 9.988 | 4.494 | 0.966 |
| 500 | A5 | NonModHist | Min | -7.486 | -6.876 | -0.921 |
| 500 | EQ | Combination | Max | 12.136 | 5.864 | 0.932 |
| 500 | EQ | Combination | Min | -12.136 | -5.864 | -0.932 |
| 500 | C08 | Combination | Max | 12.047 | 5.868 | -0.565 |
| 500 | C08 | Combination | Min | -12.225 | -5.861 | -2.429 |
| **Maximum Absolute for Case A1:** | | | | **7.429** | **3.734** | **0.941** |
| **Maximum Absolute for Case A2:** | | | | **18.459** | **5.042** | **0.875** |
| **Maximum Absolute for Case A1:** | | | | **7.429** | **3.734** | **0.941** |
| **Maximum Absolute for Case A2:** | | | | **18.459** | **5.042** | **0.875** |
| **Maximum Absolute for Case A3:** | | | | **10.755** | **6.453** | **0.920** |
| **Maximum Absolute for Case A4:** | | | | **14.050** | **7.216** | **0.958** |
| **Maximum Absolute for Case A5:** | | | | **9.988** | **6.876** | **0.966** |
| **Average of Maximum Absolutes for Cases A1- A5:** | | | | **12.136** | **5.864** | **0.932** |
| **Maximum Absolute for Case "EQ":** | | | | **12.136** | **5.864** | **0.932** |
| **"DL":** | | | | **-0.042** | **0.001** | **-0.211** |
| **"LL":** | | | | **-0.048** | **0.002** | **-1.286** |
| **DL+LL+EQ for Joint and Case: 500 C08:** | | | | **12.047** | **5.868** | **-0.565** |

# ENCLOSURE 2

## LICENSE AMENDMENT REQUEST 239, SUPPLEMENT 1 – REQUEST FOR REVIEW AND APPROVAL OF SEISMIC ANALYSIS METHODOLOGY FOR AUXILIARY BUILDING CRANE

## THIRD PARTY REVIEW OF SEISMIC ANALYSIS METHOD

**KEWAUNEE POWER STATION**

**DOMINION ENERGY KEWAUNEE, INC.**

# Third Party Review of
# *Auxiliary Building Crane Nonlinear Analysis*

R.P. Kennedy
September 7, 2008

## 1. Introduction

I provided both consulting advice and third party review for Dominion Energy Kewaunee on the Auxiliary Building Crane nonlinear seismic analysis documented in CAL-20776-SE-007 entitled *Auxiliary Building Crane Nonlinear Seismic Analysis* by American Crane and Equipment Corporation. The purpose of this analysis was to compute seismic induced accelerations and forces induced on the crane, and seismic induced reactions applied by the crane to the crane support rails. Therefore, my review concentrated on the computed seismic induced accelerations, forces, and reactions.

I carefully reviewed:

1. The five sets of three-directional orthogonal acceleration time-histories used for the nonlinear analyses

2. The nonlinear modeling of the rolling of the crane bridge girders on the crane support rails, and the trolley on the bridge girders

3. The overall dynamic model of the crane and hung cask mass (pendulum behavior)

4. The methodology used to perform the nonlinear time-history analyses

5. The development of the mean peak response quantities based upon the five individual sets of time-history results

6. The overall reasonableness of the reported accelerations, forces, and reactions.

I did not independently check any of the nonlinear time-history analyses since this checking would have required me to independently repeat the analyses performed. However, I did request that a number of sensitivity studies be performed and I reviewed the results of these sensitivity studies.

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## 2. Findings

### 2.1 Input Time Histories

The five sets of modified recorded earthquake acceleration time-histories meet all of the requirements specified in both USNRC NUREG-0800 and ASCE/SEI Standard 43-05 for use in nonlinear seismic analysis. The 2% damped composite mean response spectra from the five sets of time-histories closely match the target 2% damped response spectra at all frequencies above about 0.8 Hz. However, below about 0.8 Hz, the horizontal composite mean response spectra begin to conservatively overshoot the target response spectra by a significant amount. For example, at 0.2 Hz, the ratio of mean/target spectral acceleration is 1.26 in the EW (building longitudinal) direction, and 1.64 in the NS (building transverse) direction.

In my judgement, the five sets of acceleration time-histories are acceptable for use in computing accelerations and forces on the crane, and reactions applied by the crane to the support rails. However, the use of these time-histories is likely to lead to a significant overprediction of the rolling displacements of the bridge on the rails, and the trolley on the bridge. Two causes exist for this likely overprediction of rolling displacements. First, the mean response spectra are conservatively biased below about 0.8 Hz. Secondly, pulses were added to the recorded acceleration time-histories so as to generate time-histories that produce response spectra that match the target spectra. In my judgement, these introduced pulses are the likely cause of the significant one-way ratcheting of the rolling displacements shown in Attachment K.

### 2.2 Nonlinear Modeling of Rolling Resistance

The hysteretic modeling of the rolling resistance has been correctly incorporated into the nonlinear model. The rolling resistance of 8.0 kips per drive wheel for the bridge drive wheels and 4.0 kips per drive wheel for the trolley drive wheels are conservatively high relative to test data by factors of 1.4 and 2.0, respectively.

The bias to the rolling resistances used in the analyses results in a conservative bias for the reported accelerations, member forces, and reactions. Conversely, this bias potentially results in some unconservative bias for the reported rolling displacements. However, this potential unconservative bias for displacements is likely overwhelmed by the conservative displacement bias discussed in the previous subsection.

### 2.3 Modeling of Crane and Hung Cask Mass

The dynamic modeling of the crane and hung cask mass is excellent.

### 2.4 Nonlinear Analysis Methodology

The SAP 2000 Nonlinear Modal Time History Analysis Method is appropriate for this problem, and has been correctly implemented.

2.5 Development of Mean Peak Response Quantities

The five individual sets of peak response results have been appropriately combined to obtain mean peak response results.

2.6 Reasonableness of Reported Results

The reported accelerations, member forces, and crane reactions are reasonable and somewhat conservatively biased. These results are appropriate for use in the design evaluations of the crane, and reactions applied to the building.

I do not have similar confidence in the computed rolling displacement for the reasons summarized in Subsections 2.1 and 2.2.